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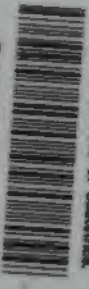
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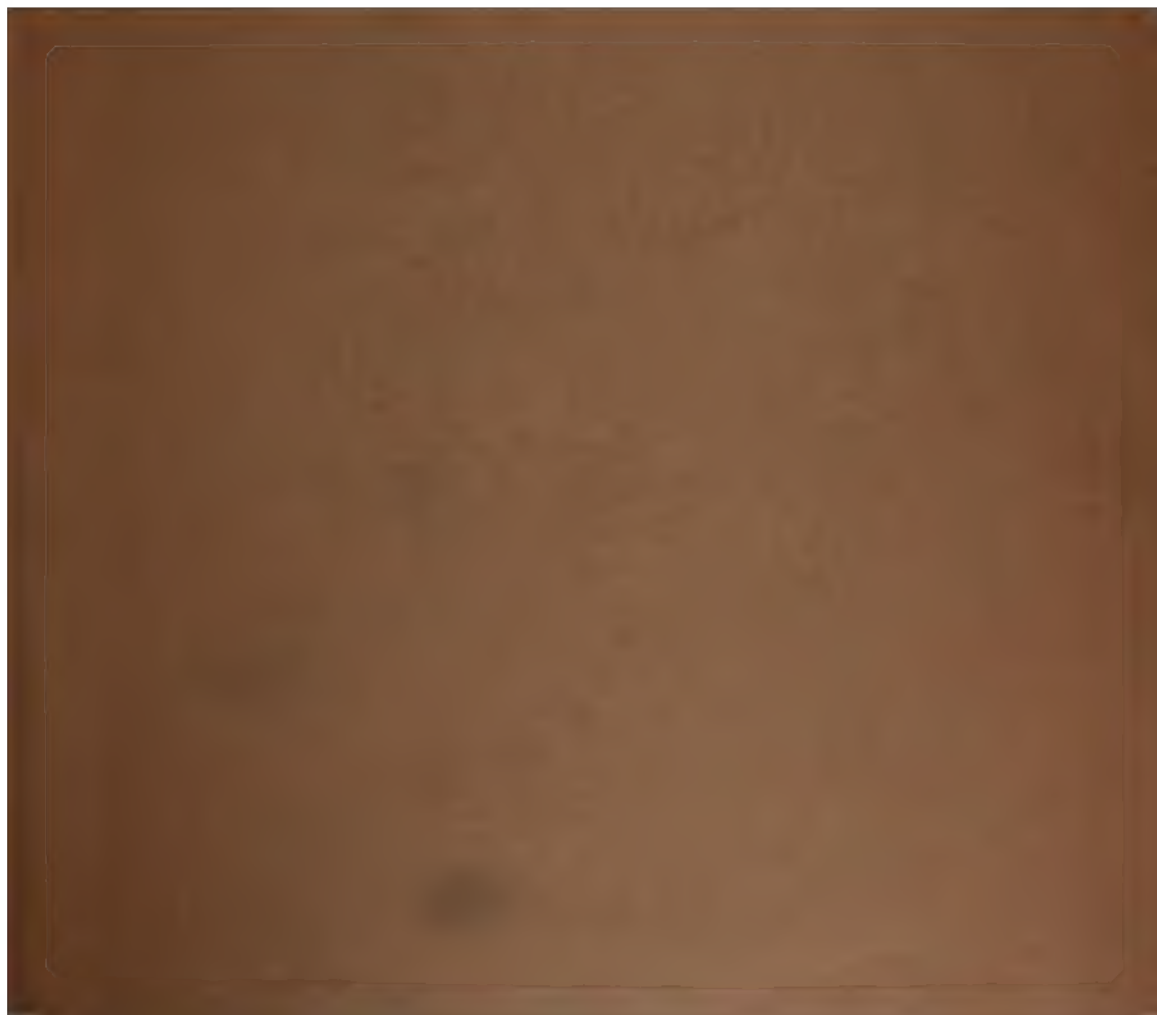
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*THE*  
PRINCIPLES AND PRACTICE  
*OF*  
OBSTETRICS

*BY*  
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*WITH 949 ILLUSTRATIONS*  
*187 OF THEM IN COLORS*

*THIRD EDITION, THOROUGHLY REVISED*

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## PREFACE TO THE THIRD EDITION

---

IN spite of the turmoil and destruction caused by the great war there have been valuable additions to the sum of our obstetric knowledge, although it must be admitted that our progress has been decidedly slowed. This has not been an absolute disadvantage, because the opportunity has been given to try out the recent contributions to science and for experience to prove the good and eliminate the error.

With this possibility in mind every chapter of the book was critically reviewed. But little pruning was found necessary. Abderhalden's pregnancy reaction, the relation of the endocrine glands to gestation, twilight sleep, the urinary tests for the toxemias of gestation acquired new evaluations.

Many subjects were amplified. They were mainly of a practical nature—obstetric anesthesia and analgesia, perineorrhaphy, cesarean section, especially the newer methods, and the treatment of contracted pelvis. In the treatment of eclampsia more prominence is given the conservative methods. Since the value of the rectal examination is now better known, it was necessary to expand the chapter on the conduct of labor with this procedure in view.

Through the kindness of Mrs. Ira Nelson Morris, wife of our ambassador to Sweden, and of Dr. Erik Ahlström, of Stockholm, and also of Privat-docent Dr. Paul Hüssy, of Basel, Switzerland, I was enabled to procure practically all of the Continental obstetric literature, which otherwise, owing to the war, would have been inaccessible.

In the revision of the chapters on Embryology and the Physiology of the Fetus I enjoyed the generous assistance of Dr. L. B. Arey, Associate Professor of Anatomy at Northwestern University Medical School.

In spite of an earnest effort to reduce the matter, several pages had to be added to the already large volume, but since they are mainly on the practical subjects (and comprise a number of new illustrations) they do not detract from the usefulness of the book to students, while they add, I hope, to its value to practitioners.

JOSEPH B. DELEE.

CHICAGO, ILLINOIS.



## PREFACE

---

THIS treatise is the outgrowth of a volume, by the author, entitled *Notes on Obstetrics*, and used for fourteen years as a text-book by the junior and senior classes at the Northwestern University Medical School.

Throughout its pages the author has constantly held in view the needs of the general practitioner and the student. Adequate space has been allowed the purely scientific subjects, and their direct bearing on daily practice has always been clearly emphasized.

Diagnosis has been made a particular feature, and the relations of obstetric conditions and accidents to general medicine, surgery, and the specialties have been fully brought out. Polemic discussion has been studiously avoided, at the risk, perhaps, of sometimes being too dogmatic.

In the preparation of the volume the works of the world's greatest authorities and the recent literature have been thoroughly studied, but the opinions expressed are mainly the result of the author's own experience in hospital, dispensary, consultation, and private practice. Twenty-one years' experience as a teacher of physicians, students, and nurses is reflected in these pages.

Lengthy bibliographies have been avoided, but sufficient recent references are given to enable the investigator to find all the literature.

For the student, owing to the crowded condition of the modern medical curriculum, brevity and system are essential, and the underlying principles of the art must be brought out. The practitioner needs a wealth of detail and of illustration to tell him what to do in a given case. To accomplish these purposes in a single volume two sizes of type have been used. Less important matter and details of treatment have been put in smaller type. For the same reasons lengthy descriptions of operations are omitted from the text, and put as full explanatory legends under the illustrations depicting the successive steps of the procedure. By studying the pictures serially, the reader will be better able to follow the operation than by referring to them from a distant text.

The subject matter is divided into four parts: The Physiology of Pregnancy, Labor, and the Puerperium; The Conduct of Pregnancy, Labor, and the Puerperium; The Pathology of Pregnancy, Labor, and the Puerperium; and Operative Obstetrics. Such an arrangement allows the easy division of the subject to fit the usual college curriculum, the Physiology and Conduct of Pregnancy, Labor, and the Puerperium being in the junior year, and the Pathology of Pregnancy, Labor, and the Puerperium, with Operative Obstetrics, in the senior year.

With very few exceptions the illustrations are original, having been drawn under the supervision of the author from fresh specimens, operations on the living and on the manikin, and from original photographs taken by himself. To Bumm's matchless work the author is indebted for many ideas, and for these, as well as for permission to copy some of his plates, the author is profoundly grateful.

James Kelly Parker drew most of the pictures; Grace Amidon did all the microscopic ones; and Hermann Becker, of Baltimore, those of the pelvic floor and the Porro operation. The tireless labor these artists put upon their work, which has extended over a period of eight years, is deeply appreciated.

The material for the illustrations came mainly from the Chicago Lying-in Hospital. The microscopic and wet preparations were generously furnished by

*Professor F. Robert Zeit, of the Northwestern University Medical School. Professor H. Gideon Wells, of the University of Chicago, also placed specimens at the disposal of the author, for all of which he expresses his thanks.*

To Dr. Heliodor Schiller the author is grateful for help in reading the proofs, and to the publishers, Messrs. W. B. Saunders Co., for most unusual generosity in the preparation of the volume.

JOSEPH B. DE LEE.

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## INTRODUCTION

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OBSTETRICS is that part of the science and art of medicine relating to the function of reproduction. The word obstetrics probably comes from the Latin *ob* and *are*, "to stand before," "to protect." While, strictly, it should be applied to childbirth or parturition, usage justifies its application to all the phases of reproduction. "Midwifery" and "tocology" are synonyms for obstetrics. The function of reproduction is a closed cycle of events, interposed in the life of a woman, and comprises five periods—conception, pregnancy, labor, lactation, and involution.

The union of the male element of propagation, the spermatozoid, with the corresponding female element, the ovum, in the genital tract of the woman, results in the formation of a cell which is capable of attaching itself to the uterine wall and developing into a fully matured individual resembling its parents. The fusion of these two procreative elements is called conception. The production of a ripe human ovum requires about ten lunar months—*i. e.*, pregnancy lasts about two hundred and eighty days, and on the completion of this period the uterus expels its contents into the external world, the process being called labor, or parturition. The reproductive cycle is continued by the breasts taking up the further nourishment of the child,—lactation,—and is completed when the pelvic organs, concerned in the process, return to their former condition. This function is called involution. This cycle may be repeated more or less often during the period of reproductive activity of the woman, which extends from puberty to the menopause. One demands that it should not cause her death nor injure her health, and that the child be born alive, well, and capable of continued extra-uterine existence.

Unfortunately, this standard is seldom attained. The process of reproduction is disturbed by many pathogenic influences in all the periods of the cycle, and many permanent structural changes are inaugurated. The study of all these processes, both normal and pathologic, is the science of obstetrics; the application of this scientific knowledge and that derived from intelligent experience at the bedside of the patient comprises the art.

In the course of the study of obstetrics it will be seen that the function of gestation affects every organ in the woman's body, and, conversely, all conditions, medical or surgical, have a more or less direct influence on the process going on in the uterus. The child, too, has its own physiology and pathology, both medical and surgical. The obstetrician, therefore, must not alone be well versed in his particular science and art, but he must also be an internist, a surgeon, and a pediatricist. The borderlands of obstetrics, with medicine, surgery, and pediatrics, are narrow and intimate. In some universities the chairs of obstetrics and of gynecology are combined, it being held that the relations of the two branches of medicine are so intimate that their separation is artificial and impractical. The obstetrician should not be a "midwife," caring only for actual births—his duty is to treat all the diseases and accidents that have to do with the reproductive function. Thus he must as skilfully repair an old perineal laceration as a new one, or treat sterility, as well as the surgical complications of puerperal infection. He must be able to remove a ruptured uterus, extirpate ovarian cysts complicating labor, as well as perform cesarean section.

While obstetrics is the most difficult and arduous of medical practice, it at the



## PART I

# THE PHYSIOLOGY OF PREGNANCY, LABOR, AND THE PUERPERIUM

## SECTION I

### PHYSIOLOGY OF PREGNANCY

---

## CHAPTER I

### PUBERTY, OVULATION, AND MENSTRUATION

**Puberty.**—At birth a girl and a boy baby are much alike. A close study will show small differences; the boy weighs, on the average, one-fourth of a pound more, the head is a little harder and larger, absolutely and also relatively to the body; a difference in the pelvis is also discernible: the female pelvis is larger and shallower than the male, and this is also true of the lower animals. More boys are born than girls—105 to 100, a proportion that prevails the world over, and for all the years, but since more boys die during labor—1 in 16—and during the first years of life, this proportion is reversed, so that later the females preponderate.

During the first years the characteristics of the sexes gradually become more marked, and as soon as the child walks the differentiation becomes apparent. The girl develops mentally and physically earlier than the boy, and one can sooner discover in her those traits of the female that distinguish it in later life. Sexually, the differences are less marked until the age of eight to ten years, when in the girl a change begins. In the boy it is noticed a few years later. This change is called puberty, or in girls, menarche (from Greek *μήν ἀρχή*), and may be defined as that period in the life of the individual when it becomes capable of reproduction. The changes are more rapid and marked in the female—indeed, her sexual life is more intense and plays a greater rôle in her existence. Madame de Staël said: “L’amour n’est qu’une épisode de la vie de l’homme; c’est l’histoire tout entière de la femme.”

The girl passing into womanhood changes physically and psychically. The pelvis enlarges, the limbs round out with fat, the neck grows more graceful, and the angularity of the body is replaced by graceful curves. The general carriage of the body is more womanly, and the movements of the person acquire dignity. The breasts enlarge, become more prominent, fuller, and firmer, the result of growth of the gland tissue and the addition of fat; the nipple becomes more prominent; the primary areola develops. Only very rarely may a droplet of secretion be squeezed from the nipple. The skin shows marked changes: its activity is increased, that of the sebaceous glands particularly, so that not infrequently comedones and acne result; in brunets the pigmentation deepens; the hair takes on more luxuriant growth, and it also develops on the mons pubis and axillæ; striæ—fine lines—sometimes appear on the thighs, and especially on the breasts. These striæ are due to stretching of the skin, the connective-tissue fibers arranging themselves in parallel lines, some of them tearing. They at first appear as purplish lines, but after several years turn a silvery white. The external genitalia grow larger, darker, more vascular, have more secretion, and emit a faint characteristic odor. The

thyroid enlarges, the larynx changes, especially in the male. In the female the voice also is altered, becoming fuller, lower in scale, and more melodious. In brunets the tendency is toward a contralto; in blondes, toward a soprano, range.

The mind undergoes alteration in its three parts—the will, the intellect, and the emotions. The will, especially during the change, becomes uncertain, and the girl loses to a good extent her control over it. Hysteric manifestations are quite common. The intellect broadens; new perceptions give a grander conception of life. The girl feels that a great transformation is taking place in her being, and the pride of womanhood and of anticipated wife- and motherhood swells in her. The emotions during the period of change also become unstable: the girl laughs and cries often without reason, is happy, gay, or sad and melancholy without cause. One must watch these manifestations—they may exceed the normal. The inclination toward the male increases, while at the same time a sense of modesty appears. Libido does not fully develop until after marriage.

This transformation is the outward expression of the changes occurring in the internal organs of generation and in the ductless glands. The uterus is developing rapidly. The vagina lengthens and becomes rugous, the tubes grow longer, the ovaries take on a special activity, ova develop, the Graafian follicles enlarge—in short, ovulation begins. With ovulation comes the ability to reproduce, but the girl at puberty is unfit to bring forth children. Cases are on record where girls of ten and even of nine years bore children, the one reported by Bodd weighing 3500 gm. Plato set twenty years as the best age for the first child, and Wernich, from a study of the development of the children of young women, decided on the age of twenty-three as the best. At this time also the pelvis has achieved its full development; the bones are still somewhat elastic, the joints supple; the coccyx, particularly, can be pressed back, and the pelvic genital tract is soft and elastic. Hypertrophy of the thyroid and pituitary glands is constant during this period, and it is certain that the hypophysis has much to do with the changes above mentioned. Overfunctioning of the anterior lobe is associated with over-activity of the ovaries.

The most important sign of the advent of puberty is the appearance of the menses, or menstruation. This is a flow of blood of several days' duration, recurring every four weeks, attended by local symptoms referable to the genitalia and general symptoms. This phenomenon, again, is dependent upon or related to the changes going on in the ovaries, called ovulation. Therefore, puberty is marked by the inauguration of two new functions,—ovulation and menstruation,—each of which will now be considered.

### OVULATION

Ovulation is that process by which an ovum ripens and is extruded from the ovary—that is, it is the maturation of the ovum or egg and expulsion of same from the ovary.

The ovary is a densely fibrous little organ, situated in the pelvis on the posterior surface of the broad ligament, in a shallow pouch—the “fossa ovarica.” It is 39 mm. long, 19 mm. wide, and 8 to 13 mm. thick, and weighs about 5 gm. The right is usually larger than the left, and is more liable to disease, because of the proximity of the appendix.

The organ is shaped like a large almond, being attached to the broad ligament by two layers of the peritoneum, between which the vessels and nerves enter its substance. The outer end is attached by one of the fimbriae of the Fallopian tube to the tube. The ovary was first mentioned by Herophilus (Alexandria, 300 B. C.), and received its name from Steno, in the seventeenth century A. D. (Fasbender). The ovaries of different women vary much in size without apparently any relation to fertility. At birth the ovary is relatively quite large. Its growth up to maturity is caused by the formation of connective tissue, vessels, and the enlargement of existing primordial follicles. Corpora albicantia were found in the ovaries of new-born and very young children by Runge. Many ova are destroyed before puberty by the constriction of the fibrous tissue. After the menopause the ovary shrinks, and in old women may be as small as a navy bean. Accessory ovaries have been found on the broad ligaments, and are probably the result of faulty development, not of fetal inflammation. A third ovary and corresponding tube have been found.

which is interesting from several clinical and medicolegal points of view. The ovary is covered by a layer of low columnar, lusterless epithelium, called the germinal epithelium, under which is the tough tunica albuginea. Beneath this are small unripe ova, while deeper down are larger ova in the process of ripening. These ova are surrounded by stroma, made up of white and elastic fibers and unstriped muscular fibers, all three most abundant at the hilum. The blood-supply is abundant, and numerous fine nerves form networks around the follicles.

The formation of ova begins early in fetal life. On the posterior wall of the abdomen of the embryo, to the inside of the Wolffian bodies, two light streaks of celom-peritoneal epithelium appear. They are supported by connective tissue, and are the primary structures of the future

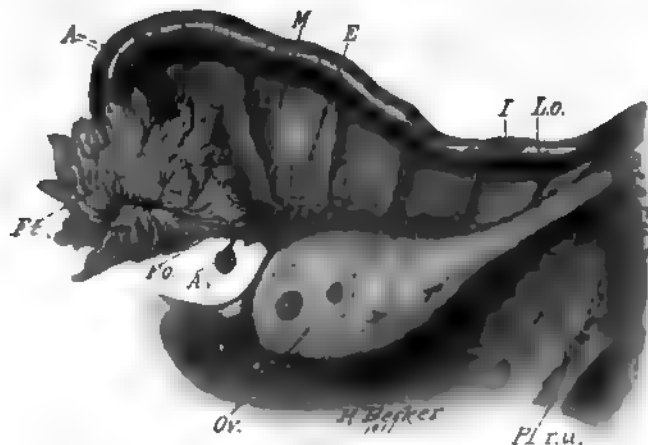


FIG. 1.—NORMAL OVARY AND TUBE.

*F.*, Fimbria; *A.*, ampulla; *M.*, mesosalpinx; *E.*, parovarium; *F.o.*, fimbria ovarica; *A.s.*, bydatid of Morgagni; *Pl.r.u.*, plica recto-uterina; *I.*, isthmus tube.

ovary or testicle. In the somewhat proliferated peritoneal epithelium (germinal epithelium of Waldeyer) are seen many cells of greater size than the others, spheric in shape, and with a pale vesicular nucleus, the primordial eggs, or ova (Fig. 3). These may develop into primordial germinal cells if the fetus is a male. The germinal epithelium proliferates actively, as do also the primordial ova, and is usually said to dip down into the stroma of the ovary, carrying with it the ova. These groups of cells are called "egg balls," or the Pflüger "ovarian tubes." The connective tissue surrounding these columns of epithelial cells grows in such a manner that masses of germinal epithelium containing one or two primordial ova are split off, until finally the ovary is formed completely of such "primordial follicles" and connective-tissue stroma (Fig. 2). According to the recent work of Felix, Pflüger's tubes do not exist in the human ovary, but the follicles arise from a

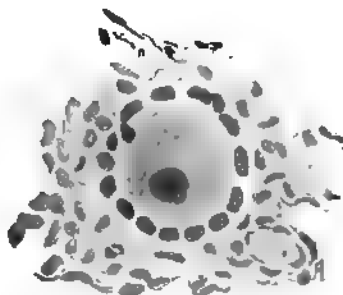


FIG. 2.—PRIMORDIAL EGG, MAGNIFIED.

cellular mass just beneath the germinal epithelium. The primordial follicles develop into the larger structures, which de Graaf discovered in 1672 and have been named after him. The ova are nearly all completed during fetal life; perhaps some are formed during the first few years of life. The ovary of the new-born infant contains ovocytes of a number variously estimated at from 30,000 to 200,000. These are closely arranged in the periphery of the ovary, while toward the hilum are a few follicles in further advancement. The main function of the ovary is to mature and discharge the ova lying in the Graafian follicles. Other functions are ascribed to the ovary, but their discussion will be made later.

When a follicle begins to ripen,—and one lying near the hilum usually undergoes this change,—it sinks toward the center of the ovary. The follicle epithelium undergoes a rapid proliferation,



a fluid appears in the center of the mass of cells, which are thus pressed against the wall of the follicle (Figs. 6 to 8). This layer of cells is called the stratum granulosum; the liquid, the liquor

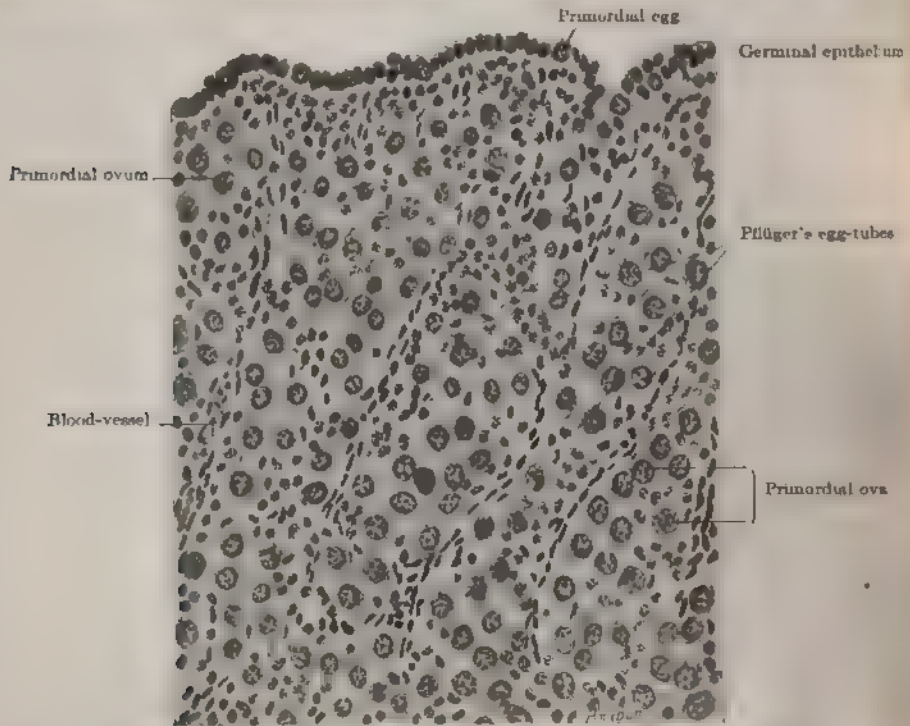


FIG. 3. OVARY OF FIVE-MONTHS FETUS, SHOWING EGG-TUBES AND PRIMORDIAL OVA.

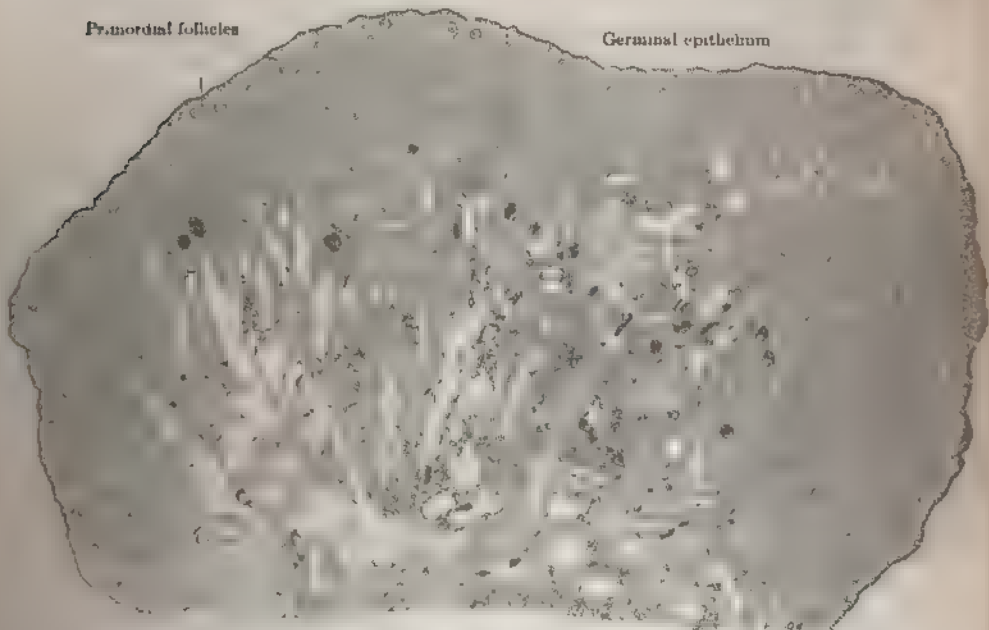


FIG. 4. OVARY OF NEW-BORN, SHOWING PRIMORDIAL FOLLICLES. FROM DR. ZELL'S SPECIMEN.

folliculi. The liquor folliculi is a clear, viscid, alkaline, albuminoid fluid, containing oil-globules and a few granules. At one part of the periphery of the follicle a small clump of cells of the stratum granulosum is seen, called the cumulus oophorus or discus proligerus, and in this von

27, found the human ovum (Fig. 5). The stratum granulosum rests on a layer of loose tissue, the tunica interna, and this in turn on a layer of closely felted fibrous tissue, externa, both of the latter being derived from the stroma of the ovary, and called the tuniculi (Fig. 8). The blood-supply of the ovary is increased, and there is a local congestion

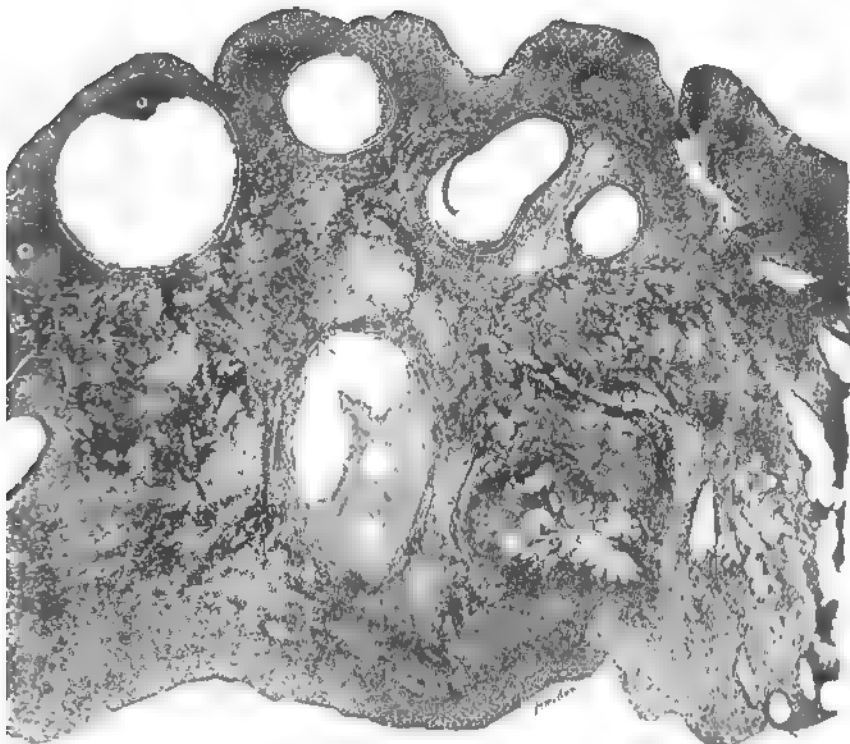


FIG. 5.—MATURE OVARY. TRANSVERSE SECTION. (Dr. Zeit's specimen.)

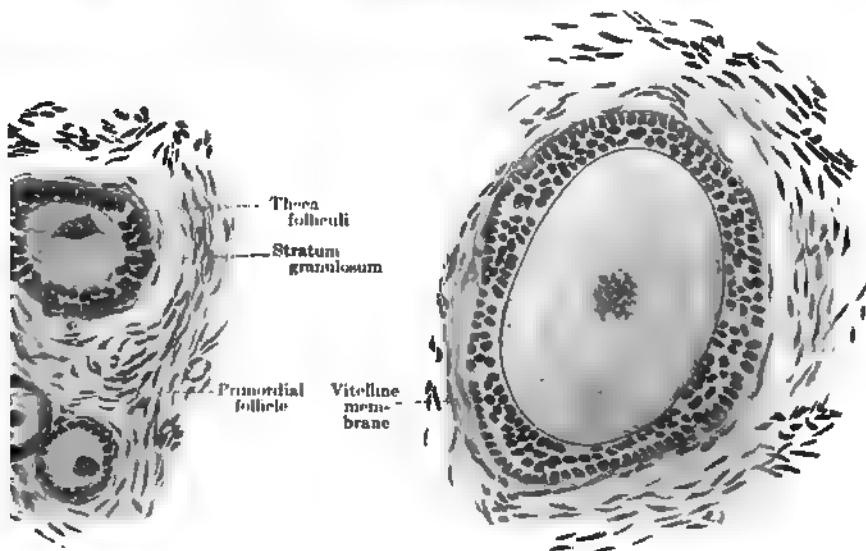


FIG. 6.

FIG. 7.

28. 6 AND 7—THREE STAGES OF THE PROCESS OF THE RIPENING OF A GRAAFIAN FOLLICLE.

e growing follicle. The cells of the follicle proliferate rapidly, the liquor folliculi in the follicle nears the surface of the ovary. At the spot nearest the surface the theca ruptures, or its fibers separate, an area of necrosis appears, and the follicle bursts at this stigma, the ovum, surrounded by cells from the cumulus oöphorus, escaping. Occa-

sionally the follicle does not burst, the ovum dies, and the follicle undergoes involution. This is abnormal, and is not called ovulation. Coincident with this transformation in the follicle changes destined to prepare it for the reception of the male element are going on in the ovum embedded in the cumulus oöphorus. The ovum is a typical cell, and consists of a cell-wall, cytoplasm, deutoplasm, or yolk, which are later in the development, and a nucleus, or germinal vesicle, with a nucleolus or germinal spot. This has ameboid motion. During the latter period of the ripening the nucleus nears the surface and undergoes karyokinesis. After the resolution of the chromatin into distinct chromosomes two successive cell divisions occur by which two small globules, or polar cells, are extruded and come to lie beneath the zona pellucida (Fig. 9). Through these divisions the chromosomes are reduced to one-half the original number. The polar globules were

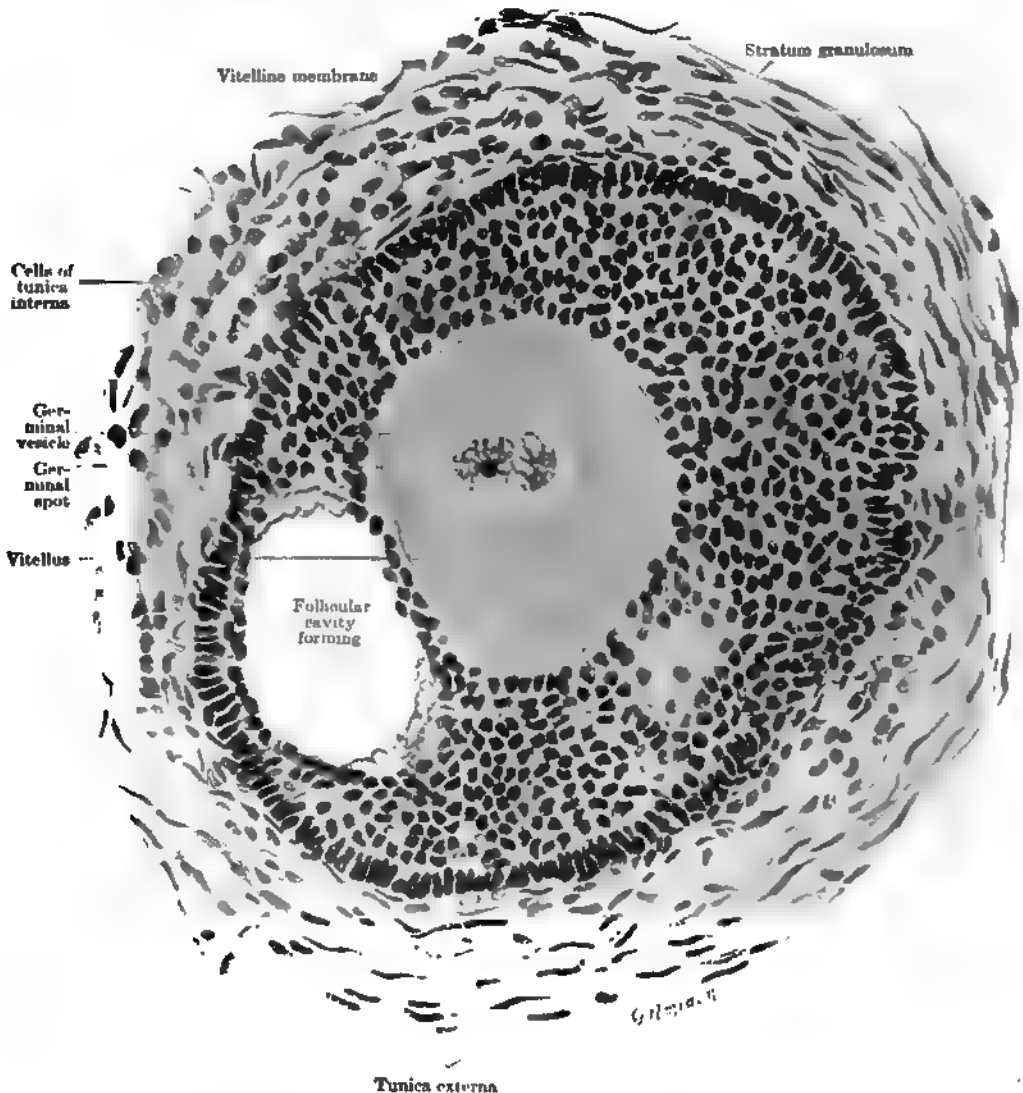


FIG. 8.—FURTHER DEVELOPMENT OF OVUM.

discovered by Robin, a French histologist, in 1821-1825. The formation of the polar globule has never been observed in the human ovum, but it occurs in all animals. The smaller germinal vesicle now rests, and is called the female pronucleus. The reasons advanced for the formation and extrusion of the polar globules are, first, that it is an excretion, second, that it leaves the ovum in an incomplete state, requiring the male element to make it fertile, otherwise parthenogenesis might occur; third, and most probable (Hertwig), that the process is necessary to reduce the number of chromosomes of the female nucleus. A similar chromosome reduction takes place in the formation of the spermatozoid, except that the end-products are all of equal size and function. The halving of the number of chromosomes in both ovum and spermatozoid prior to their union at conception, when the normal number is restored, is believed to be important in maintaining the mechanism of inheritance.

The completely matured ovum as it is expelled from the Graafian follicle (Fig. 10) is just visible to the eye as a fine white point, measuring, naked,  $\frac{1}{4}$  millimeter in diameter. It is surrounded by 100 or more epithelial cells derived from the stratum granulosum, arranged radially around the ovum, and called the corona radiata; inside this is the oölemma or zona pellucida, a thick membrane with radial fibrillations, not constant in all animals; next comes a space, which also is not constant, the perivitelline space (Nagel), and may be only an optical effect, or it may occur after the extrusion of the polar globules; within the ovum itself is a broad peripheral zone of clear cytoplasm and a large central zone of dark, coarsely granular deutoplasm; buried in the latter is the female pronucleus—which was the germinal vesicle.

The expulsion of the ovum takes place when the Graafian follicle bursts, the former having already been loosened from its bed in the cumulus oöphorus by vacuolization of the cells of the stratum granulosum. The ovum finds its way to the tube, there to await fertilization by the male element.

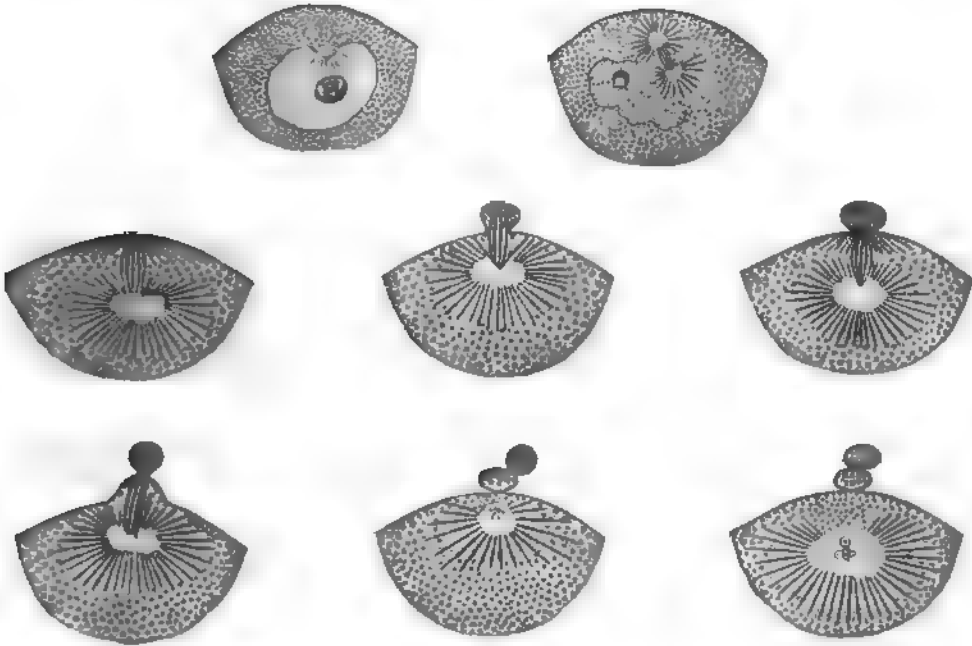


FIG. 9.—PORTIONS OF EGGS OF *ASTERIAS GLACIALIS* (1 and 2). FORMATION OF POLAR CELLS IN *ASTERIAS GLACIALIS* (3-8). (From Hertwig.)

**The Formation of the Corpus Luteum.**—After the escape of the ovum and part of the liquor folliculi out of the Graafian follicle the walls of the latter collapse, and any space remaining fills with blood from ruptured vessels of the tunica propria. It is probable that a little blood flows also into the peritoneal cavity. Rarely, enough may be lost to be of clinical importance—even fatal. Many authors believe that the stratum granulosum disappears, and the cavity is invaded by connective-tissue cells from the theca, containing a yellow, refracting pigment—lutein or, according to Escher, carotin, a substance identical with the coloring matter of carrots. Bischoff believed the lutein cells are modified epithelial cells from the stratum granulosum, and the latest work proves he was correct (Novak). There is a very active production of lutein cells, which come to lie in festoons around the central blood-clot. The small collapsed follicle grows in the first two weeks to the size of a bean, and shows the irregular yellow outline of lutein cells around the red blood-clot. Fibrous tissue grows into the lutein mass and the blood-clot from the

periphery, giving the structure its irregular outline, and at the end of three weeks the corpus luteum, as it is called, is the size of a kidney-bean. Now retrogression occurs, the connective tissue replacing the lutein cells, whereby the yellow color is changed to silvery white, the corpus albicans (Fig. 13); after several weeks more the corpus luteum is represented only by a small retracted scar.

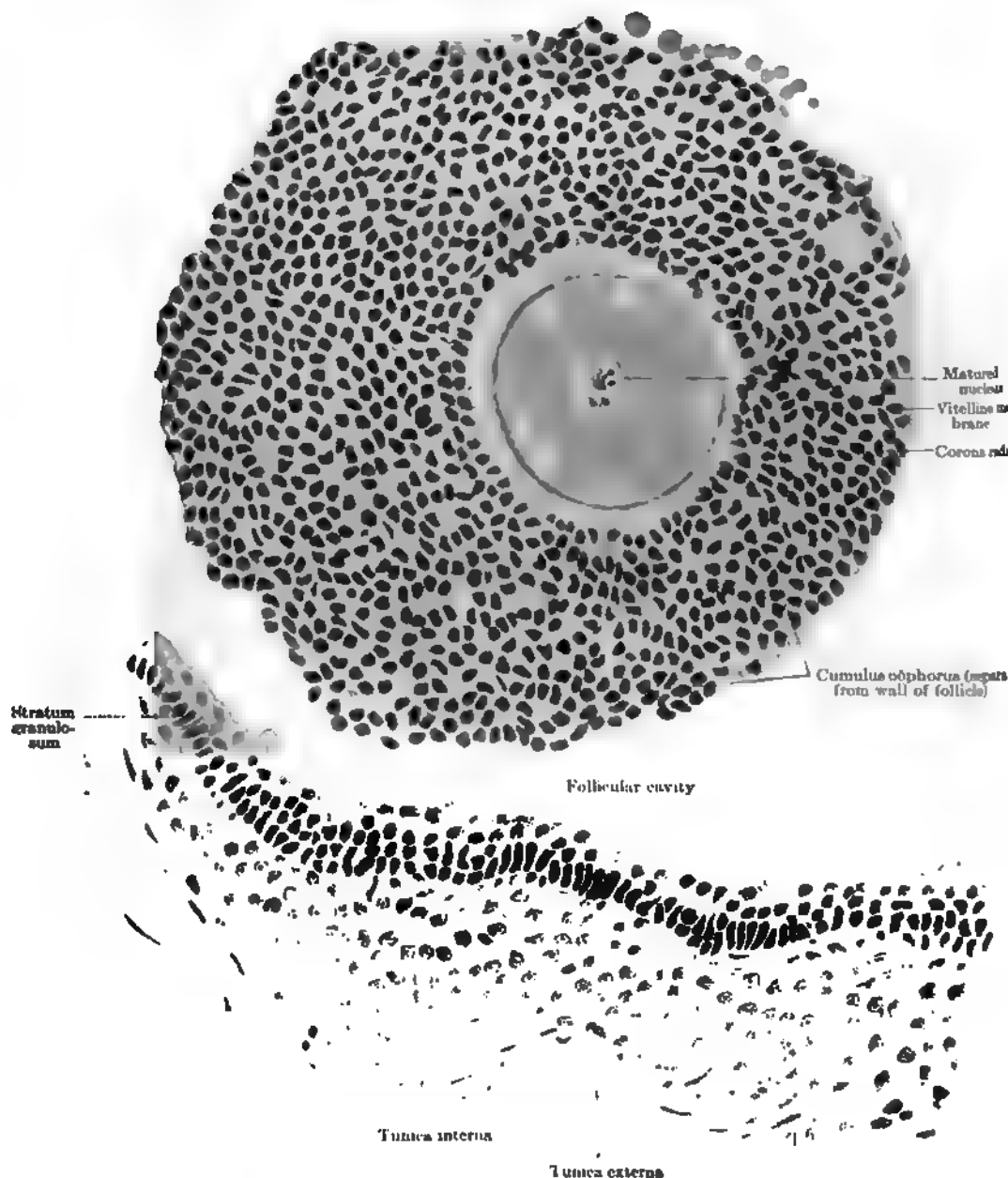


FIG. 10.—THE MATURE OVUM.

If pregnancy supervenes on this ovulation, the great vascularity of the parts, or some other factor whose nature cannot be surmised, causes an excessive growth of the corpus luteum. The histologic changes are the same as described, but they are greater and prolonged (Figs. 11 and 14). The full growth is attained at the thirteenth week, when the yellow body may take one-third the extent of the ovary, being the

size of a large hazelnut, sometimes palpable on bimanual examination. It continues of this size until toward the end of pregnancy, when regressive changes begin which are completed several months after delivery. The large corpus luteum of pregnancy is sometimes called a true corpus luteum. The small corpus luteum of menstruation is sometimes called a false corpus luteum. The French call these the epi-

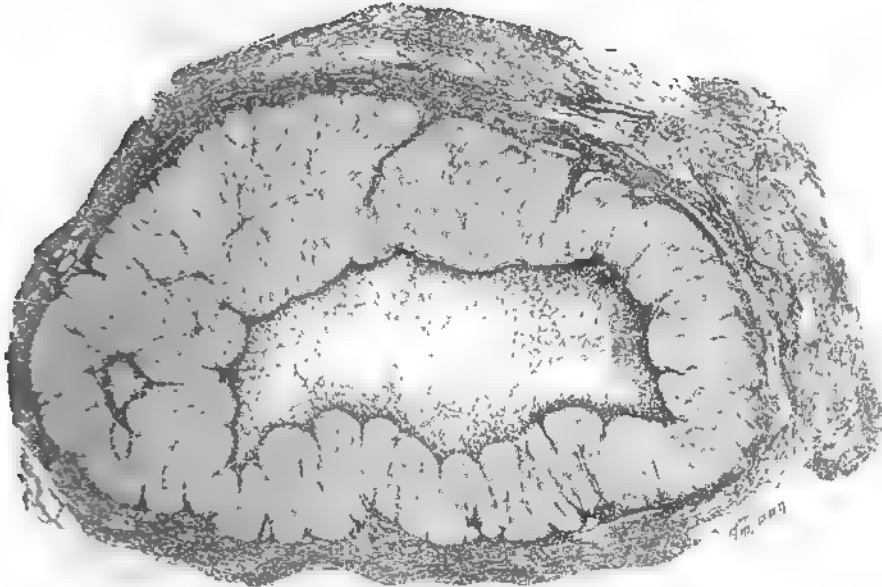


FIG. 11.—CORPUS LUTEUM VESUM.

thelial gland. Below suggests the term "glandula lutea." It is usually possible to distinguish one from the other, but, as Hirst has shown, in the ovaries of two virgins in which the corpus luteum of menstruation was almost exactly like a corpus luteum of pregnancy, one cannot always be certain. In cows they are not distinguishable. In old women with poor circulation, according to Williams, and in

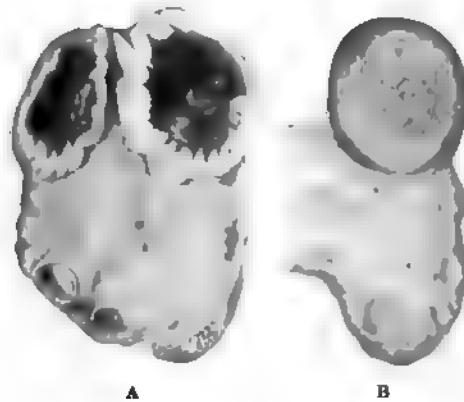


FIG. 12.—OVARY WITH CORPUS LUTEUM IN SITU.  
A, Laid open, B, from outside.

others with ovarian affections, the corpus luteum presents pathologic conditions. Some Graafian follicles do not rupture after they are ripe, and a process of pseudo-corpus luteum formation occurs also in them. Sometimes regression does not occur in the corpus luteum, but it enlarges into a cyst requiring operative removal.

**The Functions of the Corpus Luteum.**—It is more than probable that the gland-

the nidation and stability of the pregnancy are dependent on the corpus luteum, the removal of the same in the early months usually causes abortion. Later, pregnancy is less likely to be interrupted—a point of practical importance. The changes in pregnancy are also due to this hormone in the blood. Chauffard and the corpus luteum is probably responsible for the cholesterinemia of pregnancy. Seitz, in experiments on rabbits, demonstrated two ferments, luteolipoid which has hemostatic properties, and lipamin, a lecith-albumin, an antagonist which stimulates the growth of the genitalia.

The ovary has other functions. The mighty changes in the whole system of female occurring at puberty are ascribable to influences emanating from the ovary. It is now generally believed that these changes are due to an internal secretion of the ovary prepared by the cells, easily demonstrated in lower animals, and the interstitial gland, which, experiments show, causes the sexual characters. Transplantation of ovaries to distant parts of the body and proved the chemical nature of ovarian influence. The symptoms of the menopause, especially the exaggerated phenomena in the nervous system and in metabolism, observed soon after castration, and the occasional relief obtained by the administration of ovarian extract, bring clinical testimony. Ovarian extract reduces the coagulability of the blood and lowers blood-pressure. The ovary is subject to the hormones secreted by other glands of the endocrinal system, *e. g.*, the hypophysis cerebri, adrenals, the thyroid, the mamma, and in turn, influences them. It also has influence on the formation of bone, *e. g.*, osteomalacia. The most important function ascribed to the ovary, next to ovulation, is the superinduction of menstruation.

#### MENSTRUATION

Menstruation, also called the menses, the "periods," "catamenia," "monthly menses," "the monthlies," "cleansing," "the flowers," may be defined as a periodic flow of blood from the genitals, recurring every four weeks, accompanied by general

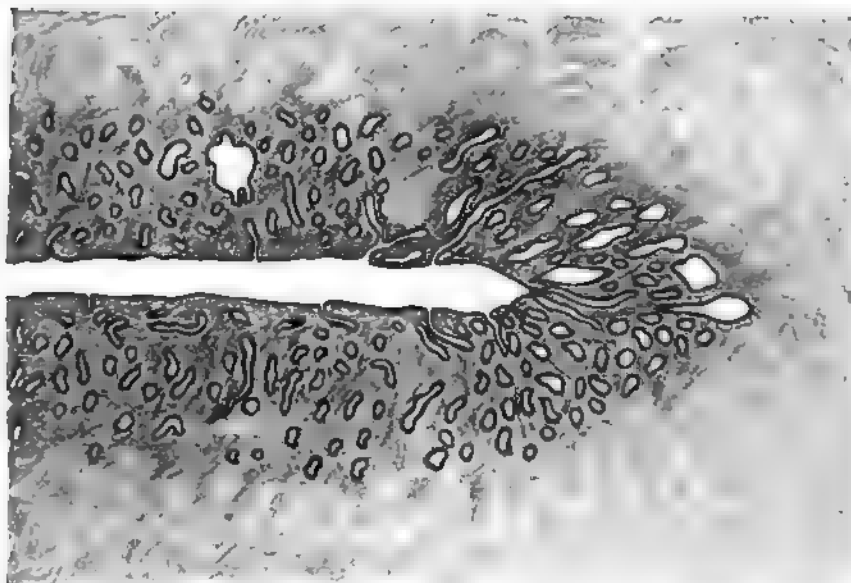
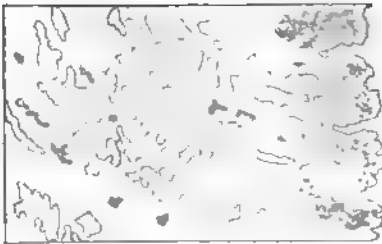


FIG. 15.—CROSS-SECTION OF UTERUS UNDER LOW POWER, NEAR MENSTRUAL PERIOD.

symptoms of malaise, nervous manifestations, etc., and local symptoms of pelvic congestion. This phenomenon occurs during the normal reproductive period of women, the *menacme* (Kisch), which begins with puberty, and continues up to about forty-five years. At this age, among other changes, the periods cease and menopause, the climacteric, or the "change of life," takes place.

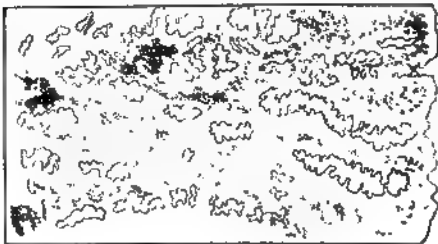
6  
Beginning menstruation (Zeit).  
Same as Fig. 18.



2  
Resting mucosa (Zeit).



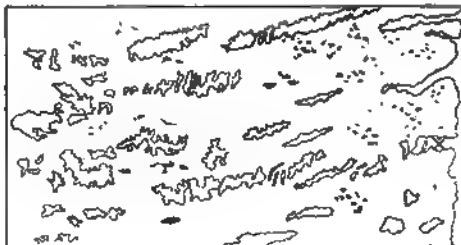
1  
Resting mucosa.



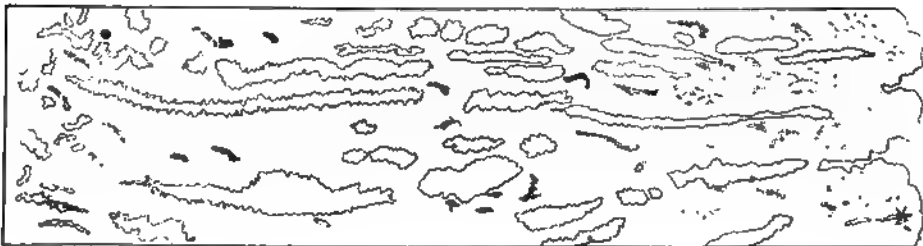
7  
Endometrium at height of  
menstruation (Zeit). X shows



5  
Endometrium at beginning  
of menstruation (Zeit).



3  
Endometrium one day before  
menstruation (Zeit). X shows



4  
Endometrium one day before  
menstruation (Zeit). X shows part



The menstrual flow begins as a whitish discharge, but soon becomes bloody, contains red and white blood-corpuscles, degenerated, ciliated, and columnar epithelial cells, vaginal and uterine secretions, and many microorganisms, some of them pathogenic.

**Anatomy.**—When the uterus is quiescent, that is, between two periods, the mucous membrane is thin (1 to 2 mm.), pale, and smooth, the glands are small, the secretion scant, the blood vessels and veins not prominent, but on the injected specimen they are seen to be numerous. Very thick is the capillary network just under the epithelium and around the glands. The ciliated epithelium is continued into the glands. It is higher in the gland lumina. The connective tissue around the glands contains many large round-cells with large nuclei (Figs. 17 and 18).

About ten days before the appearance of the menses the uterus becomes congested, grows softer, the endometrium thickens to 5 or even 7 mm., the connective tissue is filled with serum, the capillaries are filled to bursting, the epithelial cells enlarge, and the round-cells in the connective tissue are found to be proliferating rapidly, taking on the appearance of decidua cells.

The increase in length, change of color, and the more complex, and are more abundant secretion. Viewing the surface with a lens, one sees numerous small vessels with intense subhyperemia; it is shiny, has a velvety appearance. The openings of the glands are minute funnels. This is the decidua menstrualis. The secretion is strictly limited to the surface of the corpus; the cervical os does not secrete. Until the researches of Hermann and Adler were published, this normal state of the uterine mucosa, a part of the physiological menstrual cycle, was called glandular endometrium.

At the height of the congestion the surface vessels are greatly distended by blood, often ruptured, the thin epithelium is undermined and the superficial layers of the decidua menstrualis (Fig. 17) are cast off in small hematomata, may rupture the epithelium; these are called blood clots.

Some blood simply exudes through the capillary walls, many leukocytes pass by diapedesis. Menstruation is now at its height.

As described by Sir John Williams, when the whole mucosa down to the muscularis was removed, and the surface layers were cast off, the process of fatty degeneration which also affected the blood-vessels, and Leopold thought that only a few epithelial cells are cast off in normal menstruation. These are dissolved by the menses in the uterine secretion. In pathologic cases the superficial layers may exfoliate, and women often have dysmenorrhea and are sterile.

After a few days regression begins, the interglandular cells in the area of greatest congestion undergo fatty degeneration, as do also a few of the epithelial cells. The remaining portions are reabsorbed. The congestion subsides, the surface becomes anemic, the exuded serum is absorbed, the endometrium becomes thinner, the cavity of the uterus actually reduces in size, and the organ comes to rest, the process requiring about eight days.

His period of rest lasts only a few days, because the preparation for the next menstruation begins. The changes described are called the menstrual cycle, and this cycle is repeated every four weeks during the menarche, unless interrupted by pregnancy, lactation, or some pathology. These four stages of the cycle—quiescence, premenstrual swelling or preparation, menstruation or period of flow, and regeneration—were accurately described by Hirschmann and his relation to ovulation were studied by Schroeder *et al.*

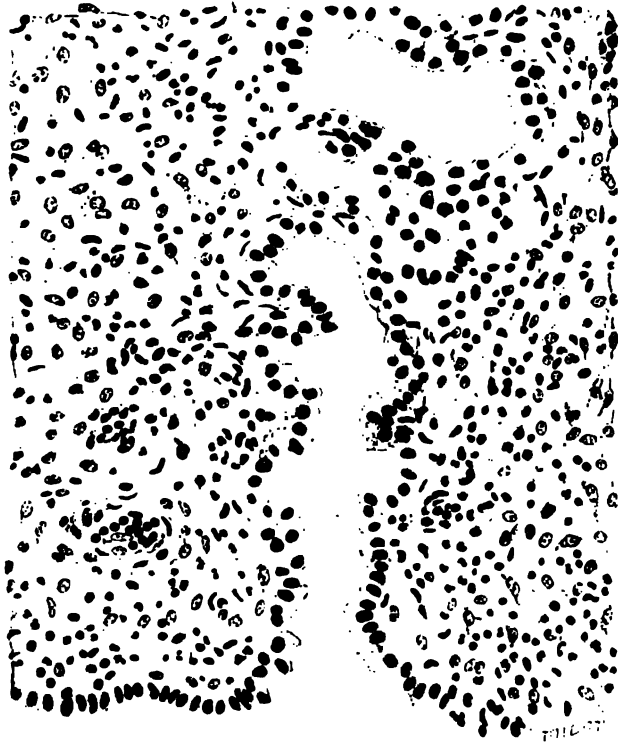


FIG. 17.—UTERINE MUCOSA FIVE DAYS BEFORE MENSTRUATION (ANGESTRUM).

the eggs are fertile. Nevertheless, ovulation is by no means dependent on coitus, and virgins perform the function regularly.

Experiments on animals have been made by Fränkel, Bouin, Ancel, Loeb, and others to determine this relation. All that can reasonably be deduced from a study of the facts is that there is a strong connection between the functions of the ovary and of the uterus; that the impulses leave the ovary and affect the uterus; that the phenomenon of menstruation is probably the result of the stimulation of ovulation, and that, while ovulation may occur at any time, the monthly ovulation is the usual one, and affects the uterus, therefore, monthly also. Meyer, Ruge, Schroeder, and Fränkel have about proved that ovulation usually occurs fourteen to sixteen days after the beginning of

menstruation, that the corpus luteum then begins to grow; the latter is at its height ten days later, the changes in the endometrium synchronizing with the changes in the corpus luteum. The changes in the uterus are designed to fit it for the reception of the fertilized ovum. Aveling called it "nest building." If conception occurs, the corpus luteum goes on growing (because of the increased vascularity perhaps, or because of the elaboration of a placental hormone) and continues throughout pregnancy, during which time it usually retards further ovulation and protects the security of the ovum. If implantation of the egg does not occur, the stimulus of pregnancy does not come to the corpus luteum, it degenerates, its secretion does not reach the uterus, which, therefore, shows regressive changes and later quiescence. The woman menstruates because she does not conceive (Power). The nest is not needed. It is notable that Leopold and Ravano found that ovulation and menstruation were dependent in 36 out of 95 cases.

It is not necessary that the Graafian follicle rupture to produce menstruation. The development and regression alone suffice. How the influence of the ovary is transmitted to the uterus is not positively known. Strassman injected fluids into the ovaries of animals and produced evidence of heat. Probably it is not via the nervous system, though nerves have been demonstrated even in the stratum granulosum (Mandl). Many experiments and clinical observations point to the action of an internal secretion. Halban has sought to prove that the internal secretion of the ovaries causes the menstruation. He transplanted ovaries to distant parts of the body of monkeys, and a sort of pseudo-menstruation continued. Then he removed the ovaries and the menses disappeared. Knauer transplanted the ovaries to another part of the abdomen in animals, and saw even pregnancy follow. F. H.

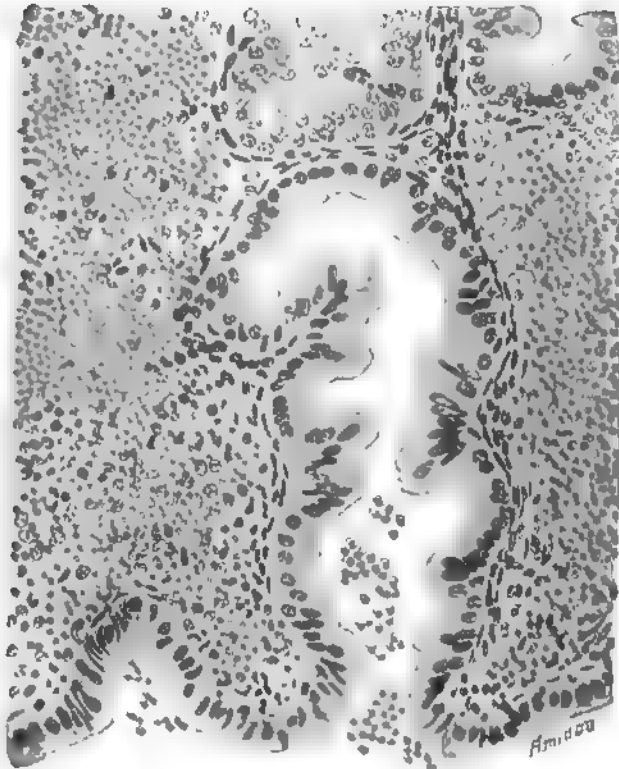


FIG. 10.—ENDOMETRIUM DURING HEIGHT OF MENSTRUATION (Zeit).

Martin, of Chicago, and Tuffier have successfully transplanted human ovaries. Tuffier also caused menstruation in the amenorrheic by injecting the blood of a normally menstruating woman.

The object of menstruation has also given rise to much theorizing. The oldest notion regarding the menstrual discharge is that it is the result of a general plethora. The woman is endowed with greater blood-making powers, as she must nourish the fetus also. If she remains sterile, there is no need for this extra blood, and it is thus gotten rid of. While by no means accepting this theory, it is interesting to note that in poorly nourished girls, or those of a tuberculous type, nature withholds the menses for no other reason, obviously, than to save the organism this useless waste of blood. Another theory, little less old, is that of a purification. Even yet by some races women, while menstruating, are regarded as unclean. The substances which were passed in the monthly discharges were supposed to be poisonous. Recently a southern writer said that cases of retention of the menses could result in headache, neuralgia, and rheumatic pains, even epilepsy. In Germany the term "monatliche Reinigung," "monthly cleansing," is still used. Schmouker and Kieffer declared that the menstrual blood is an excretion, relieving thus a toxemia. Charrin proved that the woman's blood is more toxic before and during menstruation. Turenne explained the toxemia of pregnancy as a menorrhemia, and administered ovarian extract as a remedy, but has no followers.

*Tubal Menstruation.*—There are reasons for believing that the Fallopian tubes also take some part in menstruation—first, because tubes fastened in the abdominal wall often have periodic bloody discharges; second, cases of hematosalpinx point to this action; and third, a decidua menstrualis has been found in the tube (Arendt). One might argue against this supposition that the blood regurgitated from the uterus; that in all these cases the tube was diseased, which holds true for the first two cases, at all events. The mucous membrane of the tubes may undergo changes similar to those of the endometrium without the escape of blood, as one also observes a marked congestion of the cervix, vagina, and vulva, with increased secretion of the glands, during menstruation.

### THE CLINICAL ASPECTS OF MENSTRUATION

**Time of Appearance.**—In about 2 per cent. of new-born girls there appears a bloody, mucoid discharge from the vagina, which lasts one to four days. This is called pseudo-menses, usually indicates nothing pathologic, and requires no treatment unless prolonged and profuse. Bayer ascribed it to the ovarian influence of the mother transmitted as an internal secretion to the fetus by way of the placenta. It may be due to ovulation going on at the time of birth in the mother, or even in the child. Almost always this pseudo-menses does not recur, but precocious menstruation is on record. Plumb reports the case of a nine-pound girl with genitalia like a fifteen-year-old, whose periods began six weeks after birth, and continued every six weeks thereafter. Cases of the menses beginning in the third and fifth month, with development of the genitalia and with hair on the pubis before the sixth year, are on record. This precocity is sometimes inherited. Often, however, it is the evidence of disease. The author saw very profuse pseudo-menses in two infants that died of cerebral hemorrhage. Several cases of precocious menstruation had hydrocephalus, sarcoma of the ovary, tuberculosis, or other disease.

The time of the advent of puberty and, with it, the menses, varies according to climate, environment, race, heredity, condition of life, and type of person. Warm climate seems to bring on early menstruation: the Hindus having the menses at twelve years, and English women living in India are affected likewise. In Greenland puberty begins from the seventeenth to the twenty-third year, and some of the Eskimos menstruate only in summer.

Races show marked variations. The Aryans and Slavs menstruate late, the Jews and most Orientals early. Brunets and red-haired girls menstruate early; blonds, late (Kisch). Environment exerts a strong influence. The highly strung city-bred girl has early periods, the country girl, later; the poor overworked factory girl, later; the girl reared in luxury, who dances, sees plays, reads novels, early. Chlorotic and tuberculous girls, by a wise conservatism of nature, do not menstru-

do so toward the twentieth year. Indeed, the late or scant appearance of  $\nu$  should call for a careful examination of the patient.

the mother menstruated early, the daughter may also. The same is true cessation of the periods.

**symptoms.**—At the onset of the menses the woman usually has symptoms due to the genitalia and general symptoms, which are called menstrual menses. Headache, throbbing in character, malaise, and a feeling of lassitude, *flashes*, especially of the face, chilliness, flashes of heat, all these occur and show powerful effect of ovulation on the entire body. Sexual desire is usually exaggerated; there is increased sensibility, both of the skin and of the mind, and in predisposed, hysteric outbreaks are common. The emunctories are more active and the patient more likely to take cold at this time. The skin often emits a peculiar odor; attacks of urticaria, acne, and eczema have been noticed. The eyelids often have dark circles; occasionally the lids darken as well; hordeolum, asthenopia, muscular and neural, have been often observed (Berger).

The bowels are disturbed, diarrhea and tympany occasionally occurring, and the appetite may be capricious. Mild attacks of tonsillitis are not uncommon. There is pain in the back, in the groins (ovaries), sometimes exaggerated to pathological dysmenorrhea, irritation of the bladder, and slight polyuria. The temperature is raised a degree, the pulse is faster and harder, the blood-pressure being 20 mm. until the bloody flow begins. Then it drops until the flow ceases, after which a slow rise is observed. The erythrocytes increase before, and diminish during, the flow. The amount of urea excreted is decreased, the  $\text{CO}_2$  increased. The external genitalia are somewhat engorged, darker, succulent; the discharges from the vulva, vagina, and cervix are augmented; indeed, the endometrium secretes freely only just before and during menstruation (Hitschmann). The labia majora and vagina are more open; the uterus is larger and softer; indeed, the pelvic organs suffer from an acute vascular engorgement. The acme of the changes occurs on the first day, after which regression occurs. The breasts also enlarge, become tender, and not seldom a few drops of colostrum may be squeezed from the nipples.

The nipples are more erectile and darker, the findings thus resembling those of pregnancy. The thyroid enlarges at puberty, and this may be permanent; it swells during the period, but this engorgement rapidly subsides. A relation exists between the ovary and the thyroid gland is apparent in more than one condition. The character of the flow varies in different women. It also changes from day to day. At first it is mucoserous, then bloody, then almost pure blood, which does not coagulate, a property it acquires from the secretions of the endometrium. The color is dark maroon, but in chlorotic girls it may be watery or even colorless. It is alkaline in reaction, slightly irritating, and has an odor like marigold. This is due to the constitution of the woman—some having a fetid odor—and the character of the discharge. The menstrual blood is infectious for puerperæ. Clots are usually not present. The amount varies from four to six ounces, but this, as the duration of the flow, is not constant in the same woman nor the same women. Lahille holds that more than 80 grams is pathologic.

The duration of the flow varies within wide limits, but it usually lasts three to five days. The English and American women flow three to five, the French women seven, days. At the beginning of puberty the flow is moderate; later more abundant and prolonged, especially after marriage, the result of the physiological stimulation of intercourse or of endometritis, one of the late effects of gonorrhea or syphilis. Sexual stimulation increases the flow and sometimes its frequency. Darker flow more than blonds; warm climates increase the discharge. The test as to whether the flow is normal or not is the effect on the woman. If she is well, a short or a long flow—even its entire absence—should give no concern.

**Periodicity.**—At least 71 per cent. of women menstruate every twenty-eight

days, and the majority during the new moon. If the flow starts a day earlier or later, it is of no importance. There are several types, as a twenty-eight-day type (71 per cent.), a twenty-one-day type (2 per cent.), a thirty-day type (14 per cent.), a twenty-seven-day type (1 per cent.), though some women flow every six weeks and are healthy. If one studies the life of woman carefully, clinically, and with the help of physical methods, one can determine an ebb and flow in her activities, mental and physical. It was described by Mary Jacobi in 1876. This cyclic movement, or "Wellenbewegung," or periodicity, reaches the highest point of its tide just before the appearance of the menses. Figure 20, from v. Ott, shows this graphically. The functions of the body, reflex excitability (King), the pulse, the blood-pressure, pulmonary capacity, heat radiation, temperature, excretion of urea, muscular power, all increase according to the line in the figure, up to within a day of the menses; on this day there is an abrupt regression, then a gradual recovery, which rebounds and drops to normal about the seventh day after menstruation (Reinl). This periodicity is slightly manifest in the male, and recurs in five to six weeks' intervals. Perhaps it is the external evidence of the formation of spermatozooids.

During pregnancy the menses normally are absent. Occasionally a woman will have one, usually abortive, period after conception. Cases where menstruation appeared throughout gestation are very rare, and the discharge of blood usually has a pathologic basis, *e. g.*, cervical polyp or erosion, neoplasm. Caruso and Pettay report instances. After delivery the menses reappear, according to Ehrenfest, in three months in 50 per cent. of the women, in 71 per cent. before six months, and in 81 per cent. before the women stopped nursing. The amenorrhea of lactation, therefore, is not so general as was formerly thought. (See page 217.)

The **menopause**, the "change of life," "the climacteric," "die Wechseljahre," "losing the periods," takes place between the fortieth and the fiftieth year. Thus the average length of the reproductive era of a woman's life is about thirty years.

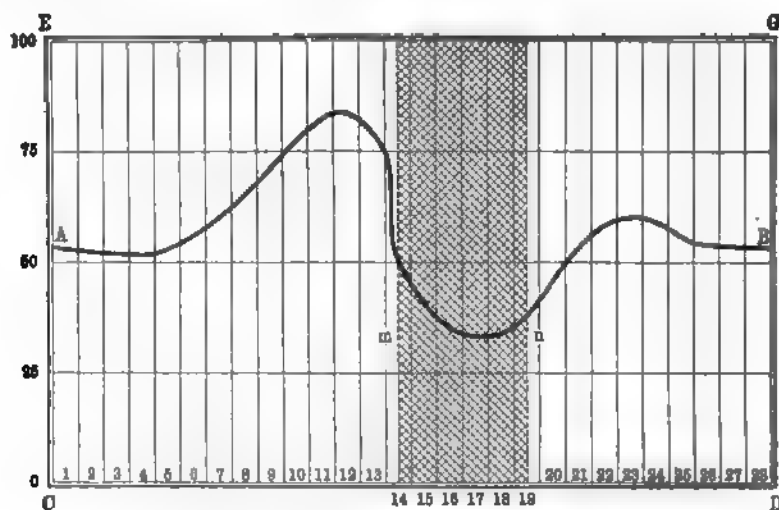


FIG. 20.—VON OTT'S TABLE OF PERIODICITY.

Statistics prove this for nearly all countries. The extremes are six to forty-six years. Krieger collected 2291 cases, and found the menses ceased in 12 per cent. of cases between the thirty-sixth and the fortieth year; in 26 per cent. between the forty-first and the forty-fifth years; in 41 per cent. of the cases between the forty-fifth and fiftieth years, and 15 per cent. of the cases from the fiftieth to the fifty-fifth years, the balance, 7 per cent., being distributed before the thirty-fifth and after the fifty-fifth years.

The climacteric occurs earlier in sterile women, in cold than in warm countries,

the poor than in the rich, in black than in white women. If puberty is early, menopause is late, the sexual function being strongly developed; but if the reproductive organs are overused or diseased, the menopause may be earlier. The menses usually return after having ceased. Meissner (quoted by Krieger, *loc. cit.*) tells of a case: Menses at twenty; first child at forty-seven; up to sixty years, 7 children; cessation of the menses; seventy-five to ninety-eight years, regular periods; five years absent; one hundred and four years, menstruation again; end not known. Charpentier, quoted by Parvin, reports a case of menses ceasing at forty-eight, beginning again at sixty, then continuing for two years. In all such cases one should search carefully for pathologic conditions, as fibroid, cancer, atheroma, mile endometritis, etc. Pregnancy has occurred after the menopause. In addition to the above, Renaudin reports a case where, twelve years after the menses ceased, a living child was born. Kennedy reports the case of a woman who had 6 labors and one abortion after the fiftieth year.

Usually the advent of the menopause is announced by alteration, diminution, irregularity of the flow. The amount of blood diminishes, mucus or serum replacing it. When the flow becomes more profuse than usual, attention should be directed more closely to the woman. The cessation of the menses, especially nulliparæ, is often attended by nervous symptoms, such as loss of vasomotor control, flushings of the face and the body, flashes of heat and cold, trembling, hyperexcitability, cerebral and spinal irritability, indigestion, constipation, tympany, nosebleed, bleeding from hemorrhoids, profuse sweats, hysteric manifestations, and many of the symptoms that accompany the beginning of the function (Currier). The body puts on fat, which often hangs in ungainly masses on the back, thighs, buttocks, or abdomen; hair often appears on the face, and the habitus in general takes on a masculine type. All these symptoms are the result of the atrophy of the genitalia. The ovaries, tubes, uterus, vagina, and vulva undergo a process of senile involution and atrophy. For further information on the changes of the menopause the reader is referred to Kisch (*loc. cit.*) and A. F. Currier.

**Vicarious menstruation** is a periodic discharge of blood from some surface other than the uterus, which discharge is to represent the monthly flow, such flow being absent from the uterus. In the typical cases three conditions must be fulfilled—the uterine flow must be absent; the periodicity absolute, and the organ from which the vicarious discharge comes, normal. Such cases are rare, but authentic ones have been reported (Kisch, *loc. cit.*). Hemorrhages have been observed coming from the nose, stomach, lungs, breasts or nipples, mouth, gums, ear, arms, bladder, conjunctiva, named approximately in the order of frequency. Sometimes the organ from which the hemorrhage comes is diseased, as ulcer of the stomach, tuberculosis pulmonum, ulcer of the nasal septum, hemorrhoids, chronic otitis media, and in themselves would give rise to a bleeding surface, but when the periodicity of the flow corresponds to that of the menses, the latter being absent, we will speak of vicarious menstruation. Occasionally the usual flow is combined with a bloody discharge from another organ. After castration vicarious menstruation has been occasionally observed, and during pregnancy and the amenorrhea of lactation a vicarious flow may occur from another part of the body. The author had a case where, for nine months after delivery, the patient had a bloody discharge from the nipples lasting several days and recurring every twenty-eight days. The nipples were healthy and the patient amenorrheic. These hemorrhages are similar to the nosebleeds observed during pregnancy, the puerperium, and the menopause.

Occasionally one notices not a bloody flow, but an increased discharge from some organ, such as leukorrhea, diarrhea, otorrhea, salivation, recurring periodically at the time of the menses.

**Midperiod Suppressed Menses.**—Between the periods some women complain of menstrual molimina without the discharge of blood. The pain sometimes necessitates rest in bed or even an anodyne. Fasbender described the symptoms,

and Martin named it "Mittelschmerz," or pain between the periods. There may be a slight increase of the leukorrhea at this time. Since the height of the development of the Graafian follicle occurs at this time, it is probable that the pain is due to the distention of a tender ovary.

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### CONCEPTION

Conception, in its obstetric sense, means the union of the male and female elements of procreation, from which union a new being is developed. It is the means for the propagation of the species, and has variously been termed fecundation, impregnation, fertilization, incarnation.

The ovum is the female unit, or element, of procreation, and, as has been learned, is prepared in the ovary for the reception of the male unit, which is the spermatozoid, derived from the testicle. In the male the testicle is the important organ of reproduction; it is analogous to the ovary, and, like it, has many organs accessory to it. The testicle produces an internal secretion, the interstitial cells of Leydig probably making it.

The testicle and the ovary are developed in the fetus from identical structures—the germinal folds along the inside of the Wolffian bodies. The germinal epithelium in the one case develops into Graafian follicles; in the other it lines the tubuli contorti of the testicle. The genesis of the spermatozooids is very similar to that of the ovum. Whereas the spermatozoid is destined, in a sort of division of labor, to be the more active, aggressive agent in the function of impregnation and must seek the ovum, by a process of evolution it is given a shape which is capable of rapid locomotion. It is made very small, being the smallest of cell elements, having been divested of all that is not needed for the performance of its function, which is to seek out the female pronucleus and fuse with it. The ovum, on the other hand, must possess the nourishment needed for the new life until the egg can derive nourishment from its parent. It is the largest cell in the body.

The spermatozooids were considered animalculæ by their discoverers, J. Ham and Leeuwenhoek (1677), but in 1840 Kölliker and Lallemand proved their origin from the epithelial cells. Spallanzani, in 1768, proved that they were the active fertilizing elements of the semen.

The spermatozooids are developed in the tubuli contorti, not in the rete or epididymis. The

periphery of the tubule is covered by a many-layered epithelium, similar in origin to the germinal epithelium of the ovary. Like the latter, it can be differentiated into two varieties of cells, spermatogonia, or spermatoblasts, analogous to the primordial ova, and supporting cells, or Sertoli's cells, analogous to the cells of the primordial follicles of the ovary. Different parts of the tubuli are active or quiet, and one may observe all the various stages of spermatozoid formation going on in the same testicle (Hertwig).

The spermatogones divide into two cells called spermatocytes; these again divide and again reducing at the same time the number of chromosomes; thus out of two spermatocytes four spermatozooids develop. These obtain nourishment from Sertoli's cells. The nucleus goes off to one side, and its chromatin forms the head of the finished spermatozoid; the centrosome forms the neck; the cytoplasm of the cell, the tail. Figure 22 shows human spermatozooids under high power. They are 55 micra long. The head is a flattened ovoid; the neck is short and granulated; the tail is long, ending in a pointed, unsheathed prolongation.

These organisms have great endurance and power of locomotion. By rapid undulations of the tail forward progression is produced, and they travel quickly all over the genital tract of the female. The life tenacity of the spermatozooids is remarkable: one may freeze them, and they begin to move again on being thawed out; acids kill them; weak alkalis favor the motions; they will live for nine days in the incubator and for two or three days in decomposing urine; they live at least three weeks in the Fallopian tube; in the bat they live for six months, and in the hen for at least eighteen days.

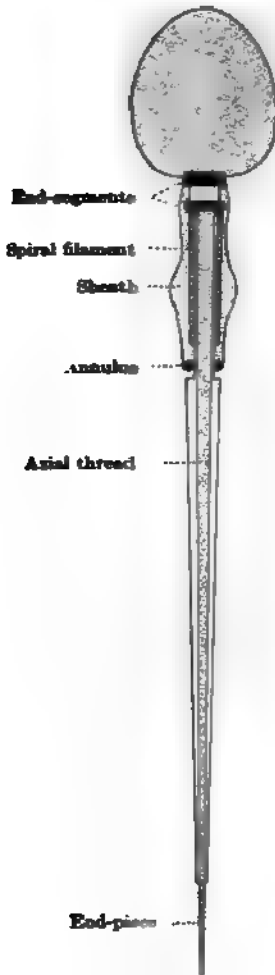


FIG. 21.—DIAGRAM, AFTER KOLLMAN.

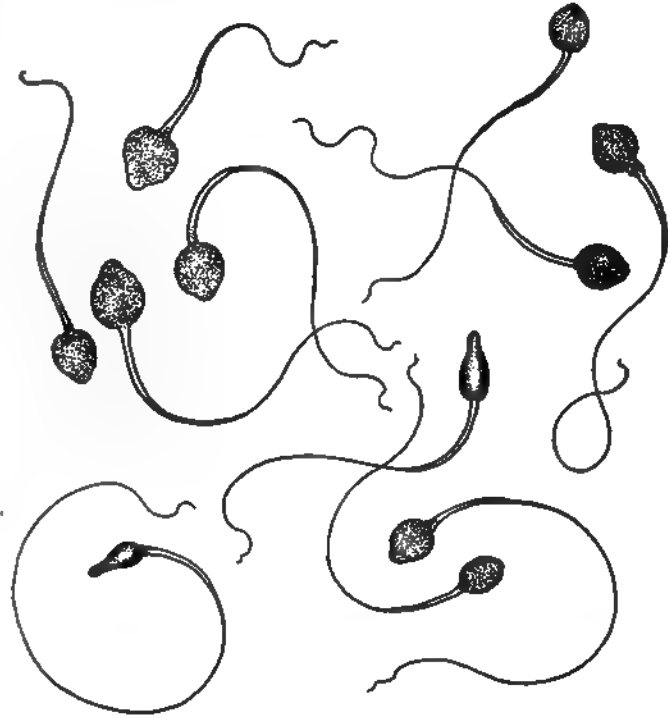


FIG. 22.—SPERMATOZOIDS (from nature).

The finished spermatozooids in clumps are pushed out of the testicle into the epididymis by the formation of sperm-cells behind, and by the cilia of the efferent ducts. In the epididymis the spermatozooids break out of the clumps and attain the power of locomotion, which is enhanced by prostatic secretion. The ciliated epithelium of the ductus epididymidis does not wave and cannot aid in the propulsion of the sperms, which now is augmented by the secretion of the epididymis. The motion of the body in walking, compression of the testicle when sitting, the contraction of the muscular fibers of the tunica albuginea, the elasticity of the same when distended, have been advanced as causes of the movement of sperms out of the testicle and epididymis. The passage of the semen along the ductus deferens is accomplished by the contraction and expansion of the ductus, perhaps peristaltic, aided by the ciliated epithelium. When the semen reaches the ampullæ of the ductus deferens, it accumulates here, awaiting ejaculation. With the ejaculation a mixture occurs, with the secretion of the vesiculæ seminales, the prostate, Cowper's glands, and the glands of the urethra. The vesiculæ seminales are not primarily receptacles for the semen, but glands which furnish a thick yellowish secretion made up of globulin. The function of the vesiculæ as storehouses for the semen is much questioned. They may be organs for the



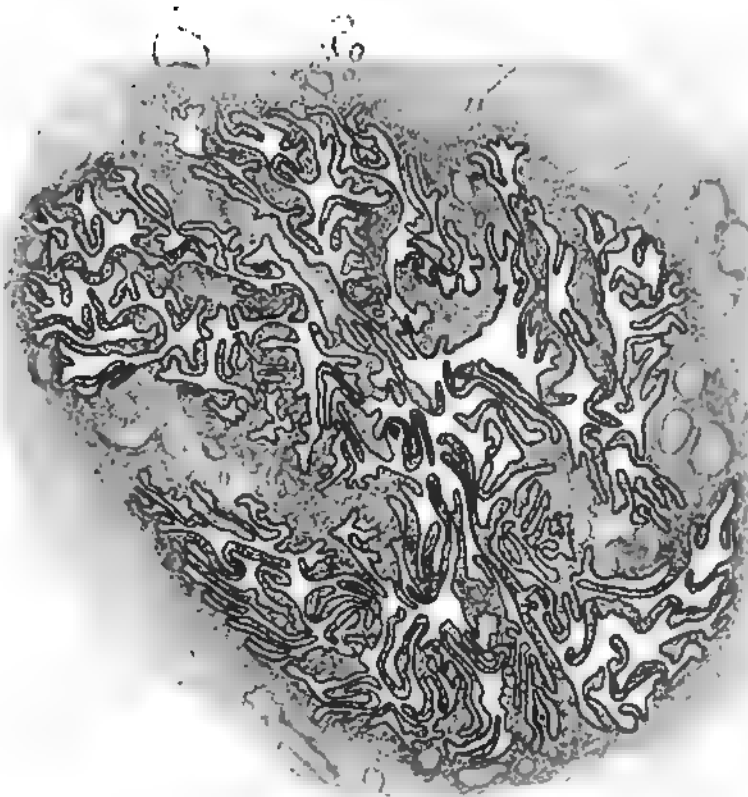


FIG. 23.—CROSS-SECTION OF TUBE AT AMPULLA (low power).

reabsorption of unused semen. The prostatic secretion stimulates the spermatozooids to active movement, perhaps by chemic influence or by dilution. The spermatozooids from the epididymis of the dog have been found capable of fertilisation.

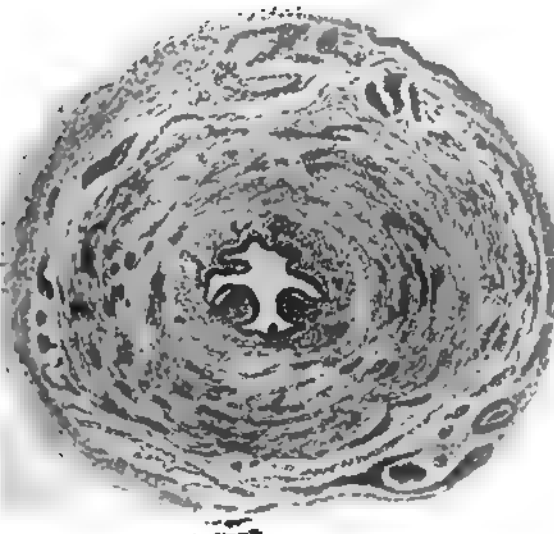


FIG. 24.—CROSS-SECTION OF TUBE NEAR UTERUS.

The semen is a thin, yellowish-white, creamy fluid, alkaline, mucilaginous, and has an odor peculiar to itself. The odor is due to a mixture of the various glandular secretions, particularly that from the prostate, called spermin. The amount discharged varies from 1 to 10 c.c.; the average is 3 c.c., but much larger amounts have been collected. It contains the spermatozooids, the spermatie cells, epithelium, leukocytes, and crystals. The number of spermatozooids in a given ejaculation is sometimes enormous—227,500,000 in one discharge (Loxle). Without doubt many are killed by the acid secretions

of the vagina. The number decreases to nil if cohabitation is carried out many times in rapid succession, but regains the normal after a day's rest.

The specific gravity of the semen varies from 1027 to 1046; it has 90 per cent. water and 6 per cent. mucin, the rest being albuminoids, fats, and salts. Spermin, the odorous element of the semen, comes mostly from the prostate, but it has been found in other organs and fluids (Schreiner), as the blood of leukemia, the sputum of bronchiectasis, the testicle, the ovary, the pancreas, the spleen, and the thyroid (Poehl).

**Copulation.**—Conception, impregnation, incarnation, and fecundation must be well distinguished from copulation, which means the sexual union of the male and the female.

The object of the voluntary act of copulation is solely to place the semen in such a location that its living elements, the spermatozooids, may reach the ovum. The rest of the function of reproduction is entirely involuntary. The act of copulation is not absolutely necessary; if the semen is injected into the vagina or even into the introitus vulvæ, conception may take place. The union of the spermatozooid with the ovum occurs, in all probability, in the outer end of the Fallopian tube—the ampulla. The frequency of tubal pregnancies indicates this. That the impregnation may occur in the ovary is proved by authentic ovarian pregnancies,—indeed, several primary abdominal pregnancies, one attached to the omentum, have been reported,—and that the union of the two elements may occur in the uterus itself is not impossible.

How does the ovum reach the tube from the ovary? The ovary lies in a little depression,—the fossa ovarica (Fig. 1),—and is covered in part by the mesentery of the tube, whose fimbriæ are in close proximity. The ampulla of the tube presents outward in numerous projections—the fimbriæ, the prolongations of the longitudinal foldings of the tube (Figs. 23 and 24). These are covered with ciliated epithelium. The waving of the cilia being toward the uterus, an efficient aspiratory current is produced in the peritoneal fluid of the neighborhood of the end of the tube. Experimentally in rabbits Lode saw tiny particles placed near the tubes actually sucked into the fimbriated end. They appeared finally in the vagina. It is very questionable if the erection of the tubes on the ovary, formerly held, could possibly occur. The tube is too delicate to lift the heavy intestines. The ovum, as it appears on the surface of the ovary, with its clump of cells from the cumulus phorus and a few drops of liquor folliculi, is caught in this current and led to the tube. Once in the tube, the peristaltic action of the wall of the latter will aid its progression toward the uterus, aided by the ciliary wave. The length of time required for the passage from ovary to uterus in the dog is eight to ten days; the mouse, four to five days; the guinea-pig, seven days; the opossum, five days; the human, four to eight days—but of this one cannot be certain. The figures are for the fertilized ovum. The only unfertilized human ovum found outside the ovary was in the case of Hyrtl, where, four days after the beginning of the period, a woman, a virgin, died, and at the microscopic autopsy an unquestionable ovum was found in the interstitial portion of the tube.

How do the spermatozooids reach the ovum lying in the ampulla of the tube?

There are several theories which are more or less accepted:

1. That the semen is ejaculated directly into the uterus is disproved by the anatomy of the uterus.
2. That the penis acts as a piston, forcing the semen into the uterus, is not plausible. It occurs only in pigs.
3. That the uterus in a state of erection, after coitus, relaxes and aspirates up the semen, which lies in a pool in the back of the vagina, into which the cervix dips. There is some color to this view, but if so, the uterus ought to suck up the various germs, etc., existing in the vagina, which is contradicted by the fact that the uterine cavity is aseptic. That the semen is held back in the vagina by contraction of the pelvic floor muscles is proved. Owing to the coagulation of the semen, the result of the mixture of the prostatic with the secretion of the seminal vesicles, the early discharge from the vagina is hindered. If the pelvic floor is lacerated, this retentive action is lost and may give the cause of sterility.
4. That during copulation a piece of cervical mucus hangs from the cervix, and on relaxa-

The woman is now pregnant, the fertilized ovum proceeds to the uterus, pulled by the cilia of the tube and aided by its peristalsis. The uterus has been prepared for the reception of the egg (see anatomic changes of uterine mucosa during menstruation), the egg attaches itself to the decidua menstrualis, and the development of a new individual is begun. These processes do not always occur in the exact order described; observers have for a long time been aware that various exceptions occur. The spermatozooids may pass out through one Fallopian tube and fertilize an ovum lying in the closed uterine horn of the opposite side. This is called *external wandering of the spermatozoid* (Fig. 25). The ovum may wander from one ovary of one side into the tube of the other, as in a case of extirpation of the

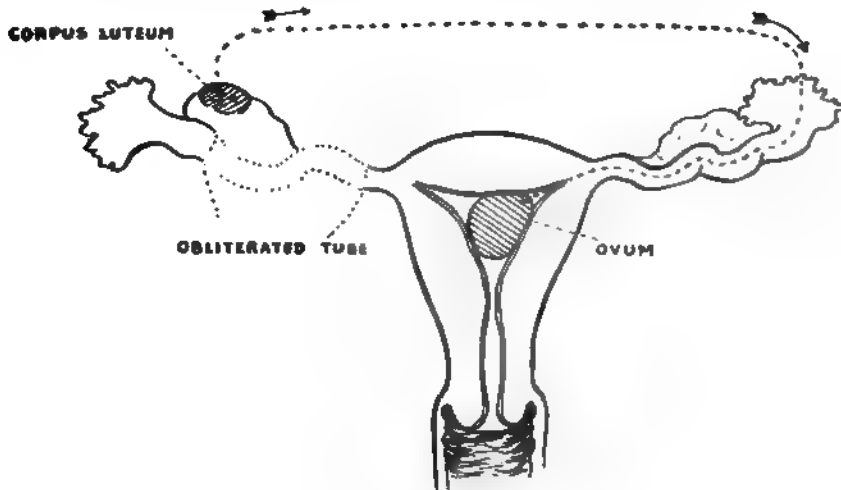


FIG. 26.—EXTERNAL WANDERING OF THE OVUM.  
Dotted red line indicates course of ovum.

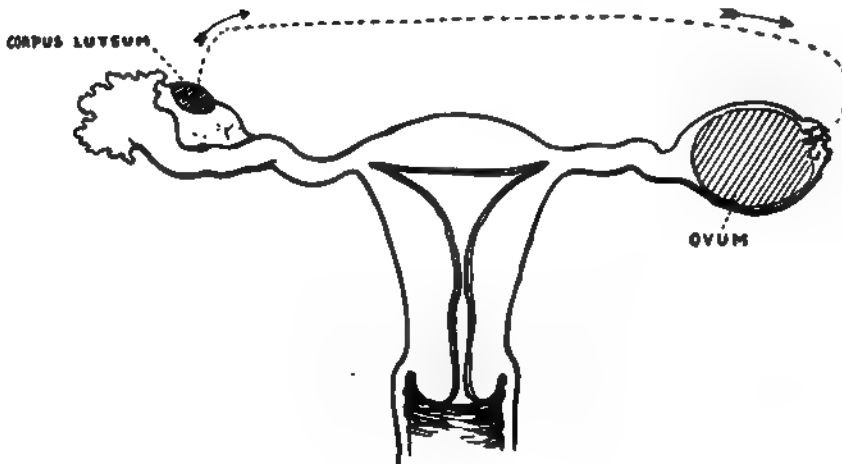


FIG. 27.—EXTERNAL WANDERING OF THE OVUM (Oldham's case).

right tube and left ovary, the ovum crossed over and entered the healthy tube (Fig. 26). In a case of extra-uterine pregnancy the corpus luteum was found on the right side, the ovum in the left tube (Fig. 27). In animals, too, one has found more fetuses in one horn of the uterus than there were corpora lutea in the corresponding ovary.

Now Halban, Ruge, and Meyer have shown that ovulation occurs most often about sixteen days after the beginning of the menses.

It is certain that rupture of the Graafian follicle and conception may occur at any time during the reproductive life of women. An ovum may be fertilized by spermatozooids which have been waiting for many days. Siegel, of Freiburg, from study of statistics obtained from women whose husbands came home from the front on short furlough, concludes that most conceptions occur just after the menses cease and the incidence is least just before the next period. (See page 70.) No doubt the menses may occur after conception has taken place. It is customary to reckon the length of pregnancy as of nine calendar months, or ten lunar months, or hundred and eighty days' duration, dating from the first day of the last menstruation. Clinical experience shows that most labors occur at this time. If Reich's theory is true for the majority of cases, one will have to conclude that the normal length of pregnancy is two hundred and fifty-two days, and this is contradicted by the length of time occurring from the date of a single insemination to labor, i. e., two hundred and seventy-two days, which is the average of a large number of authentic cases. Further, if the theory that the ovum from the first menses conceived is fertilized is the true theory, the majority of women ought to have a period of amenorrhea of three hundred and eight days instead of two hundred and eighty days, during which time they considered themselves pregnant. But we know that the great majority of the cases the period of amenorrhea is of only two hundred and eighty days' duration. Therefore unless we are willing to admit that pregnancy lasts only two hundred and fifty-two days, we must concede that the majority of conceptions occur at the time around the last menses present.

If further study shall prove, as Fränkel, Ruge, Meyer, Schroeder, *et al*, claim, that ovulation occurs from fourteen to eighteen days after the beginning of the last menses, and if, as should be surmised, conception occurs also about this period, then we must conclude that human gestation is not two hundred and eighty days nor two hundred and fifty-two days, but two hundred and sixty to two hundred and sixty-five days in duration.

The season of the year influences the number of conceptions. The months of May and June show the most, perhaps as an analogon to the mating of birds and animals. In many countries May, June, and October are favorite months for marriages. In country districts during the harvest-time there are fewer conceptions. The body is tired with hard work. After the harvest an increase is noticeable. In countries where conscriptions for soldiers take place, there are many conceptions before the time the men leave for the army. Illegitimate conceptions occur most often during the summer months. Climate exerts an influence, too; in the very cold regions the frequency of conception is less; in warm zones the contrary is true. Among the educated classes conception is voluntarily much interfered with, but there are those who believe that the number of impregnations falls off among them from natural causes.

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the ovum, the tail disappears and the cell-membrane thickens, which prevents spermatozooids from entering the egg. The neck of the spermatozoid centrosome (not present in all species); the head swells up and becomes the pronucleus. Both nuclei are made up almost wholly of chromatin. The cytoplasm is arranged in radiating lines about the centrosome. The nuclei gradually approach each other and fuse (Figs. 30 and 31), the chromatin forming one long convoluted thread. The nucleus is now capable of division; it is the primary "segmentation," or "embryonic nucleus." The first division of the embryonic nucleus has been completed (Figs. 32-35). Each daughter nucleus receives an equal number of chromosomes; therefore

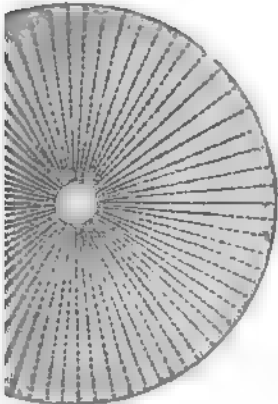


Fig. 32.

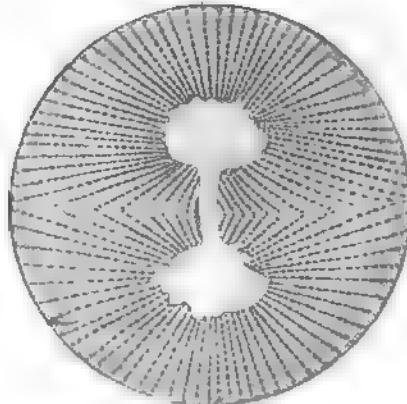


Fig. 33.

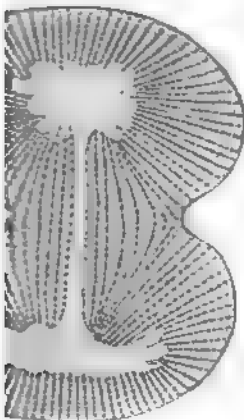


Fig. 34.

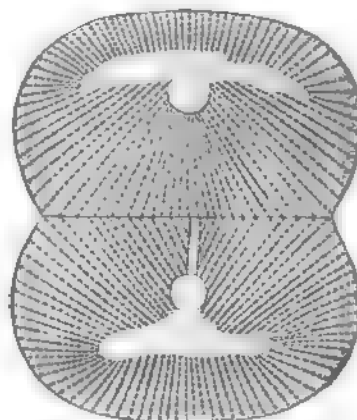


Fig. 35.

FIGS. 32-35.—FIRST CELL DIVISION, EGG OF SEA-CRCHIN (HERTWIG)

endowed with half paternal and half maternal qualities and attributes. of race, of external form, of family traits, of susceptibility to disease, instances of disease itself,—insanity,—is transmitted to the new individual by the chromatin of the male and female pronuclei. This must have structural qualities which are far beyond our physical powers of dissection. Within the microscopic mass of chromatin are contained the elements of life, the seeds of millions of cells, of the most diverse description, and carrying on their functions.

The segmentation nucleus forms a spindle with a centrosome at each end. The chromosomes are arranged around the middle of the spindle at first, then

each divides in two equal parts, which separate toward the ends. The achromatic fibers of the spindle dissolve in the middle, and, while this process goes on, the cytoplasm divides also. The process of karyokinesis is now complete. Two cells are formed, and thus the new individual is begun. Each daughter-cell divides again into two and again in geometric progression until a mass of cells results (Fig. 36). This mass, which resembles a blackberry in shape, is called the morula. In some animals all its cells have the same qualities as the parent cell, because broken pieces of the morula have been found to grow into a complete embryo (Driesch). These changes occur inside the zona pellucida, while the ovum is passing down the tube. The cells of the corona radiata are lost during the transit through the tube. When the morula has passed the uterine end of the tube, at which time it cannot be much more than 0.2 mm. in diameter, it attaches itself to the wall of the uterus.

The next step in the development of the egg is the blastula formation. The cells of the morula multiply with great rapidity, and a serum appears in their center which forces the cells to arrange themselves around the periphery of the egg, forming the blastodermic vesicle. The zona pellucida is stretched, persisting a varying length of time after the impregnation of the egg.

The blastodermic vesicle (Fig. 37) at first consists of a single layer of cells,

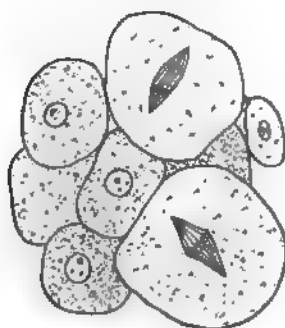


FIG. 36.—THE MORULA (MOUSE)  
(Bobotta).

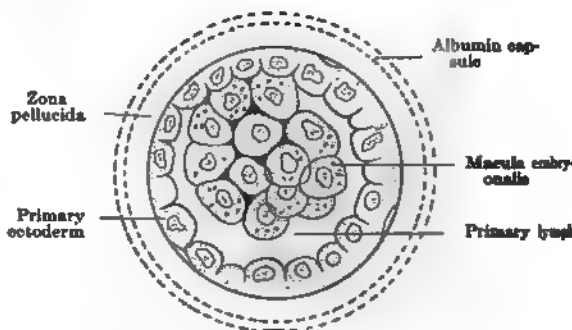


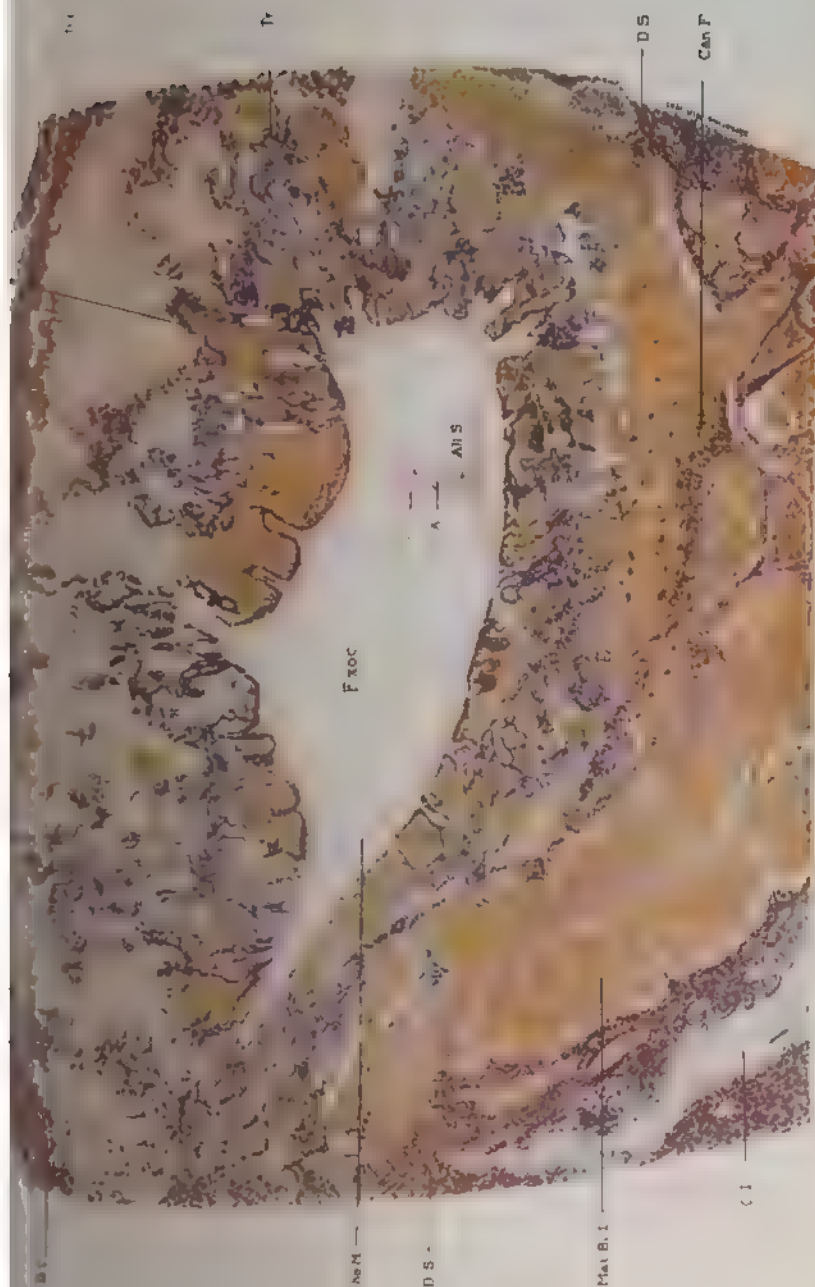
FIG. 37.—THE BLASTODERMIC VESICLE (RABBIT) (E. v. Benedek).

with, at one pole, an accumulation of darker pigmented cells—the later are embryonalis. This layer divides into two—an outer, called ectoderm, epiblast, or ectoblast, and an inner, the entoderm or endoblast, separated by a space. The egg is now called a gastrula, and a third layer of cells develops between the other two, called the mesoderm, or mesoblast. This later divides into two—the splanchnic and the somatic layers; thus are we introduced to the study of embryology, which does not belong in the pages of this book. Only such points as are necessary for the consideration of the formation of the fetal envelopes will be presented.

The uterine mucosa has already been described. Under the influence of the corpus luteum it has been prepared for the reception of the fertilized egg. It is thicker, velvety, soft, spongy, vascularized, and the glands are full of clear secretion. The condition of the ovum as it enters the uterine cavity is unknown; probably it is in the morula or blastula formation. Probably the zona pellucida has disappeared, and with it the cells of the cumulus oöphorus, the corona radiata.

One of the earliest human eggs ever described is that of Kretz-Peters, and since the findings in this egg are supported, in the main, by those of other human *ova* (v. Spee) and of animals (Hubrecht and others), the conclusions drawn by *others* will be generally accepted in the following description. Bryce and Teacher recently published a description of the earliest human ovum. They estimate its *age* as thirteen days. Herzog published, in 1909, a classic description of an early *human* ovum, and permits his plate to be here reproduced (Plate I).

# PLATE I.



All S., Allantoic stalk. C.A., Cavity of amnion. Can.F., Canalized fibrin. Cho.M., Chorion mesoderm D.C., Decidua capsularis.  
 Floc, Fibrin clots. A, Amnion. All S., Allantoic stalk. D.S., Decidua capsularis. Mat B.I., Maternal blood. C.I., Chorionic intervillous space. V.S., Vitelline sac. Syn., Syncytium.  
 Tr., Trophoblast.

**Embedding of the Ovum in the Uterine Mucous Membrane.**—The ovum is pushed into the soft mucous membrane by the elastic pressure of the walls of the uterus, and more probably, its ectodermal cells eat their way through the epithelium, probably at a spot that happens to be without cilia, and the ovum thus

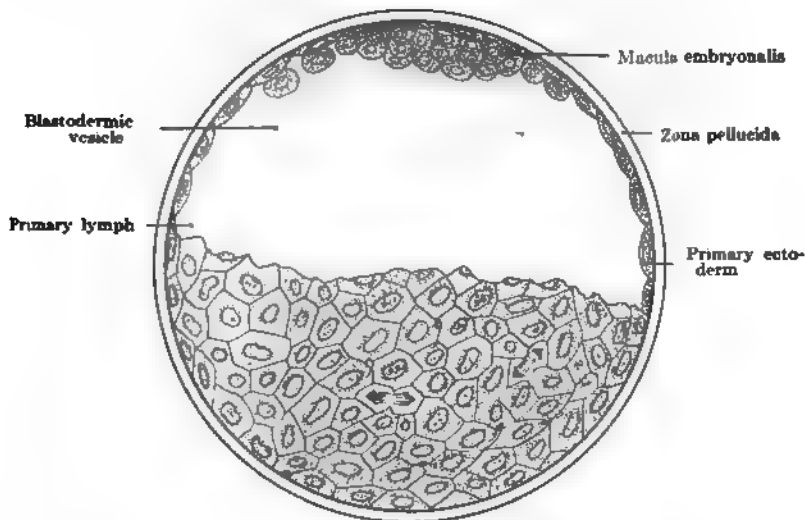


FIG. 38.—LATE BLASTULA (RABBIT) (E. von Beneden).

is pushed into the edematous subepithelial connective-tissue stroma (Figs. 39 and 40). It is known that the epiblastic cells have tryptic power, and only a tiny surface, space of a few epithelial cells, has to be denuded. The ovum does not enter the mouth of a uterine gland; it does not necessarily fall into one of the uterine

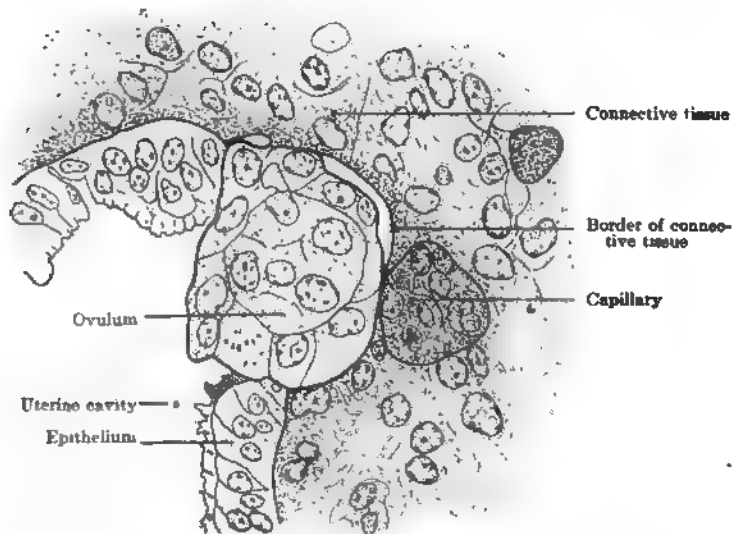


FIG. 39.—EMBEDDING OF OVUM IN MUCOSA (GUINEA-PIG) (V. Spee).

though it is possible, but then the changes that would follow would not be from the usual; it, by a process of arrosion, burrows into the endometrium. The reaction to the invasion by a local congestion, with edema, diapedesis of white blood-corpuscles, and a thickening of the outer layers of the stroma cells



of the mucous membrane. The spindle-shaped cells under the epithelium around the glands quickly form large rounded or ovoid cells with a single nucleus—the decidual cells. These are much more numerous near the surface, forming a rather compact layer. The glands widen and undergo proliferation at the base and are filled with secretion. In olden times this was called the uterine milk. The decidua menstrualis is being transformed into a decidua graviditatis, and the two layers, compacta and spongiosa, are already being differentiated. (See pp. 13 and 14, under Menstruation.) In the early stages the two may hardly, if at all, be differentiated.

The ovum sinks into the compacta; the opening through which it entered is closed by a mushroom-like cap, or by the growth of the lateral portions of the decidua and epithelium over the tiny aperture. The changes in the human ovum up to this time—about the eighth day, not as Peters would have it, the third or fourth day—are unknown. In the Kretz-Peters egg, the first fetal formation was

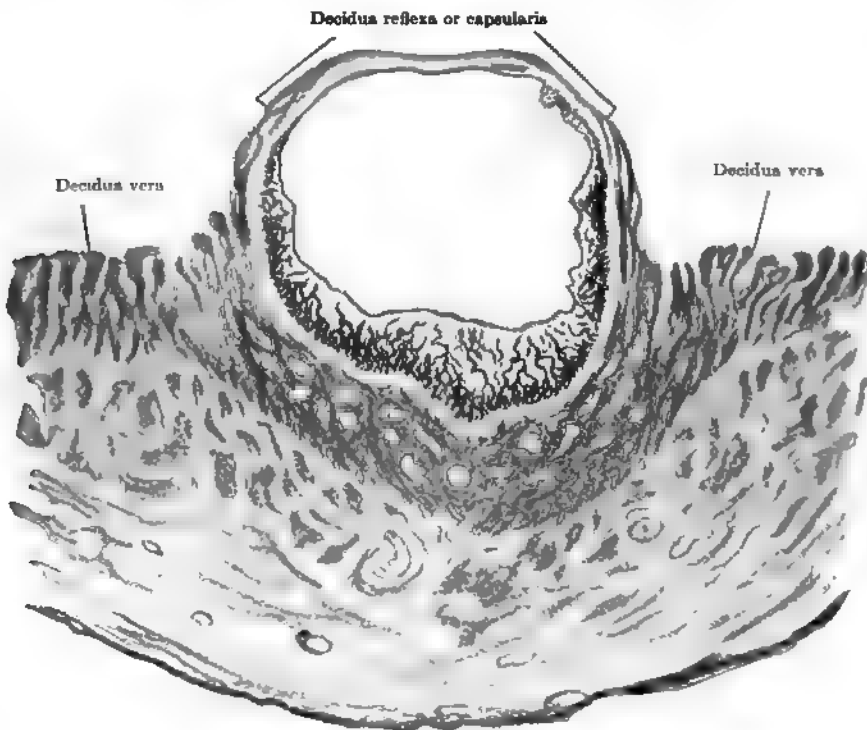


FIG. 40. -OVUM DISTENDING MUCOSA. SHOWS ARRANGEMENT OF UTERINE GLANDS (semi-diagrammatic).

already in progress, the amniotic cavity and chorion being completed. The epiblast or ectoderm—rather, that portion of the layer not concerned in the formation of the embryo—grows into the decidua, and provides for the nourishment of the egg. It is the epithelium of the chorion, and is called trophoblast, because of its nutritive function. The cells are irregularly cubic, with a large round or oval, slightly granular nucleus, and sometimes with a nucleolus. The trophoblast grows into the compacta in all directions, but irregularly, and when it meets the dilated capillaries, it pushes into them, the endothelium of the latter being destroyed, thus allowing the blood to wash the surface of the trophoblast. This causes the cell protoplasm to swell, and the cells to form a homogeneous mass, and the nuclei to alter and assume irregular forms—the syncytium. The trophoblast forms a shell around the egg, which lies in the dilated capillaries of the thickened mucosa. The area around the trophoblast

the trophosphere, and its dilated vessels, serous imbibition, and hyperplastic decidua provide the most favorable medium for the nourishment and growth of the ovum. In addition the uterine glands secrete with blood, and this occurs regularly in all the latest stages so that it may be considered normal. The blood also flows into the lacunae formed in the trophoblast. We thus see the importance of the formation of the decidua spaces.

In the mesodermal layer of the ovum connective tissue is supplied by the allantois and by fetal blood-vessels entering the irregular interior of the trophoblast (see Fig. 40), and thus the first villi are formed.

The growth of the ovum is effected by the thickening or invagination of the mucous membrane which is soon bulged outward the cavity of the uterus in the form of a hemisphere. The villi are separated from each other by 40  $\mu$ , and arrange themselves tangentially to the growth.

The layer of mucous membrane that is pushed up in the form of a cover is called the capsularis, that portion of the ovum rests, the decidua basalis, and all the rest forming the lining of the uterus, the decidua vera. The term membrane decidua was applied to a fibrinous exudation on the lining of the uterus during pregnancy, and named "decidua," because it is cast off at labor and the puerperium.

Now Bulbo taught that pregnancy is exfoliate to appear on the surface of the endometrium, and the ovum coming down, the tube is membrane ahead of it, this latter portion was called decidua. Since the same kind of membrane was found under the ovum, it was thought that this was the decidua vera.

Hunter (1774) retained these names, but described a different mode of formation of the decidua, according to which the ovum is surrounded by a reduplication of the decidua vera, is walled

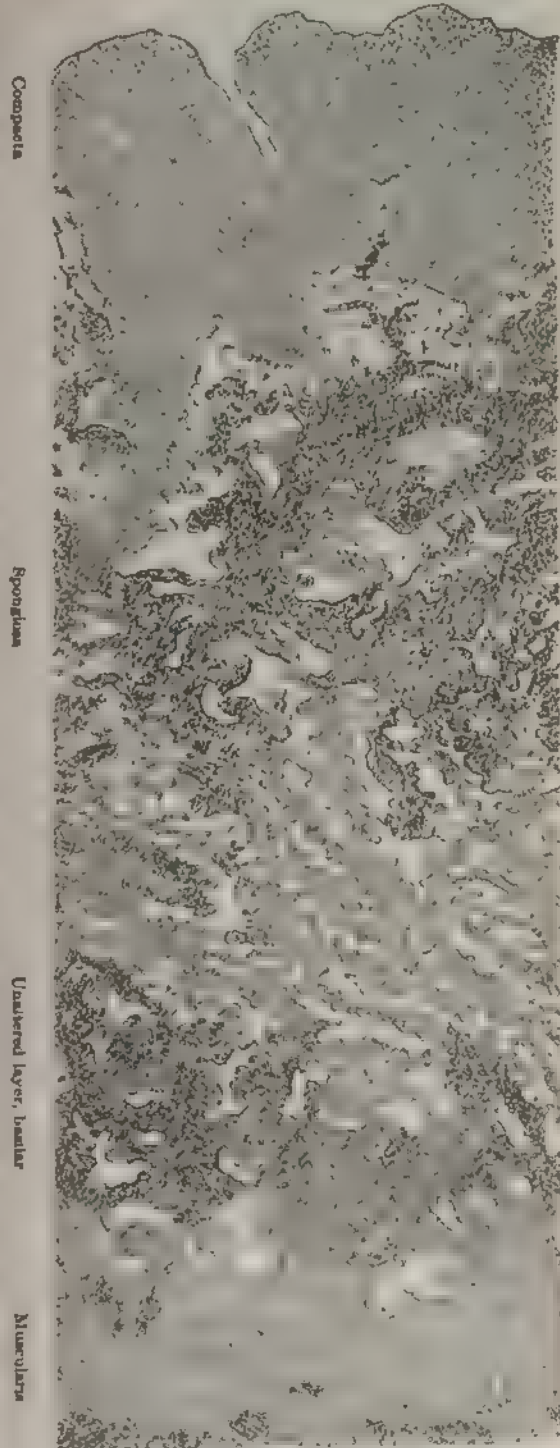


FIG. 41. DECIDUA AT THIRD MONTH. LOW POWER.

around, and covered over by the growth of the exuberant decidua. Another notion was that the ovum was caught between two folds of the thickened decidua menstrualis. This may be true in some cases. Many authors still retain the old names *reflexa* and *serotina*, but, according to modern ideas of the histology of the endometrium, the terms *capsularis* and *basalis*, proposed by His, are better.

The endometrium undergoes many changes from the beginning to the end of



FIG. 42.—SECTION AT JUNCTION OF DECIDUA AND MUSCULARIS (high power).

pregnancy. The cervical mucous membrane normally takes no part in the formation of the decidua. It undergoes marked changes which will be considered later. Sometimes the ovum becomes attached in part to the cervix, but this is pathologic (*placenta prævia*). In the first weeks the lining of the uterus is hardly distinguishable from the membrane of menstruation. The marked proliferation of the glands, resulting even in a papillary formation with clumped epithelium, which Opitz declared characteristic for pregnancy, the vascularity, the beginning formation of decidual cells, the thickening, all these

are similar, so that no one can positively identify a given bit of tissue as having come from one or the other condition. At the end of the third month the *decidua vera* has reached its greatest development (Fig. 41). The membrane on the anterior and posterior walls is thickest, even as much as 1 cm., the areas at the sides of the uterus, and usually the fundus, are less thickened, and when the lining is cast off, as in abortion at this time, the edges present a sieve-like appearance from the openings

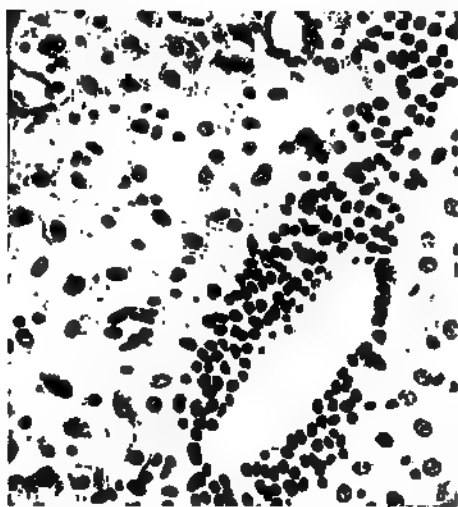


FIG. 43.—AREA COMPACTA. OBLIQUE SECTION OF GLAND. THIRD MONTH (high power).

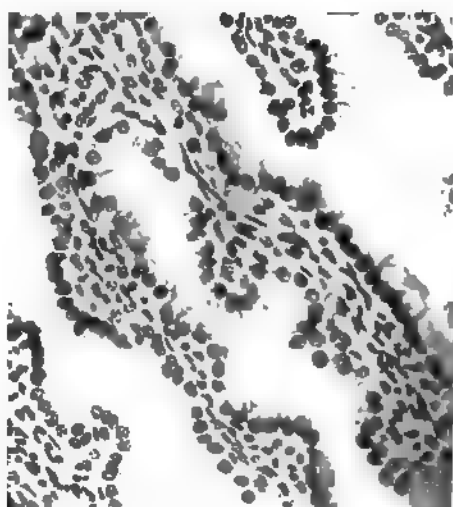


FIG. 44.—AREA SPONGIOSA (THIRD MONTH) (low power).

of the uterine glands through the thinned portions (Fig. 374, p. 433). The inner surface is rugous—that is, thrown into deep folds, but smooth; the outer, detached is shaggy.

Microscopically, examination of an early decidua vera (Fig. 41) will show. (1) The epithelium, in most places absent; if preserved, it is around the openings of the glands and in the deeper portions of the same; (2) the compact layer of the

early one-half of the whole thickness, made up of the swollen and hyperillary stroma and many decidual cells, which are large, ovoid or spindle-shaped, with much protoplasm, with single or rarely several large vesicular nuclei derived from the stroma, not from epithelium, which they so much resemble (Fig. 43); (3) the glandular or ampullary layer, or spongiosa (Fig. 44), composed of enlarged, elongated, and convoluted uterine glands, often with papillary infoldings of the epithelium, which is low and cuboid without cilia, and containing decidual cells; (4) a small, unaltered layer through which the glands of the fundus sometimes slightly into, the muscularis. The glands pursue a straighter course in the basilar portions of the compacta than in the spongiosa. The arteries run around the glands, up to the surface, where they break into capillaries. At the insertion of the ovum the blood-vessels are most numerous and the arteries are most dilated. The veins here are enlarged, and open into the intervillous spaces. The glands are pushed aside by the growing ovum (Fig. 40).

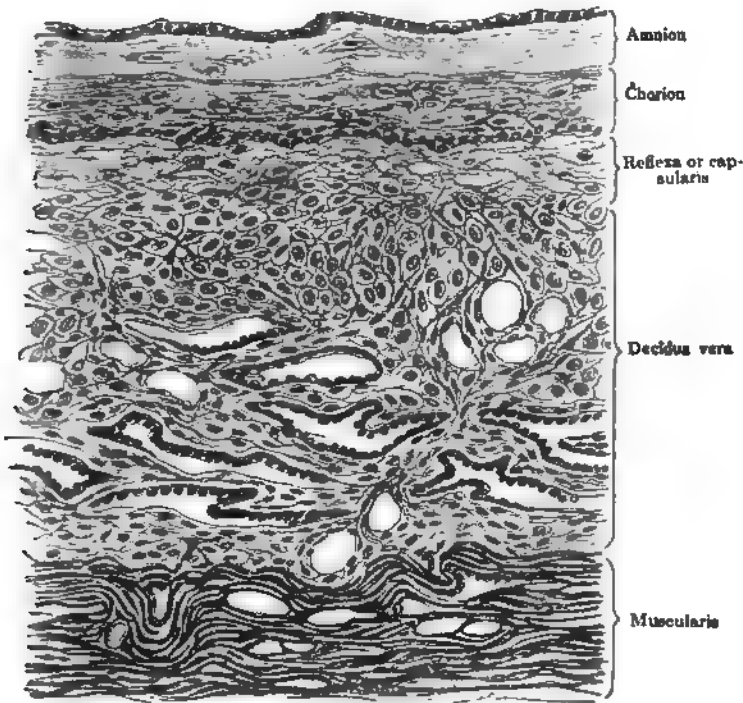


FIG. 45.—DECIDUA AT FIFTH MONTH (from Bumm).

*Decidua basalis* or *serotina* is a portion of the decidua vera altered only by the imposed growing ovum. It has the compacta and spongiosa, but the blood-vessels, which latter are enormously developed, are stretched to parallel to the wall of the uterus, and, at the junction of the capsularis, stretch upward into it. (See Fig. 40.) The portion of the basalis next to the chorion or trophoblast is called the trophosphere, and will be again considered under the head of Placentation. The basalis, of course, must grow rapidly in the proportion up with the growing ovum, and this it does both by its own hyperplasia and by the splitting of the compacta of the neighboring vera. The glands of the *serotina* degenerate early, and, owing to the great and rapid growth of the ovum at the site of insertion of the ovum (the site of the future placenta), are compressed into a lamellous layer of spongy tissue. The basalis shows progressive as well as regressive changes, and they will also be considered under Placentation. *Decidua capsularis*, or *reflexa*, is that portion of the vera which is stretched

over the ovum (Fig. 45). It is thick at the equatorial portion and thin at the outer pole. This is the point where the egg buried itself in the mucosa. This point, which is microscopic, is soon covered in, so that in later stages it cannot be found. The portions near the base resemble the vern; the blood-vessels are more numerous; the veins larger, and the capillaries open into intervillous spaces. The glands are arranged tangentially around the ovum, and one finds glands opening obliquely on the surface (not into the cavity of the trophosphere), almost up to the vertex of the capsularis. The tissue is soft; the decidual cells numerous; also the so-called syncytial giant-cells. The uterine epithelium is flattened at the vertex, cuboid at the sides, without cilia, and disappears early. The portions of the decidua near the top of the capsularis early assume a fibrinous character, without glands, vessels, or epithelium, all these disappearing as the apex is reached.

As the ovum grows and fills out the cavity of the uterus the decidua undergo many and material changes. The capsularis at first is stretched over the ovum, and soon reaches the opposing wall of the uterus, on which it lies, but does not

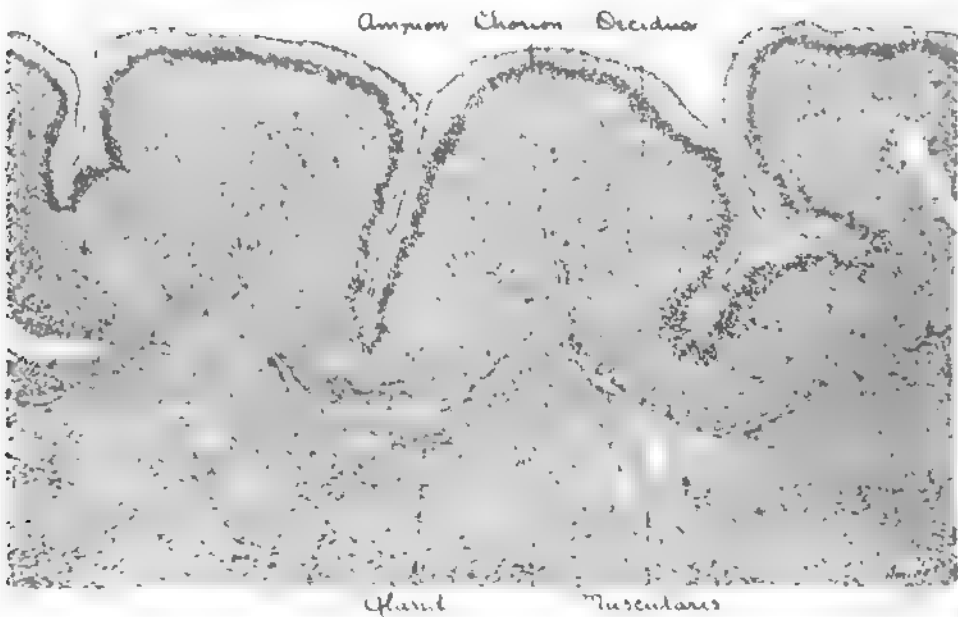


FIG. 46.—DECIDUA VERA AT TERM (low power). (SHOWS WRINKLING DUE TO SHRINKING OF SURFACE OF UTERUS (Specimen from cesarean section))

adhere. The uterine cavity is completely obliterated by the fourth month. The capsularis undergoes coagulation necrosis, and is absorbed at the sixth month, though occasionally portions of it can be found on the membranes at term. The chorion adheres to the vera and on the delivered secundines large portions of the latter are found attached to the former. At the edges of the placenta one usually finds a thick layer of decidua in fibrinous degeneration, the site of the transition of vera and basalis into reflexa. This is the closing ring of Nitabuch-Winkler.

The decidua vera grows rapidly in thickness until the end of the third month; from then on it thins out until at term (Figs. 46, 47) it is only 1 mm. thick or in places even less. It must grow actively, also, because it has not enough tissue to stretch and cover the immense ovum at term. The epithelium is all gone except in the glands of the lowest layers of the spongiosa and those between the muscle-bundles. From these remnants the new uterine mucosa is reconstructed. The compacta is reduced to a narrow strip, and most of the decidual and stroma cells are in process of coagulation necrosis. The glands of the compacta are separated from each other, while in the spongiosa they form a thin, loose, flattened network,

since the stroma here too is beginning to degenerate, separation of the ovum from the uterine wall is easy. Nature is thus preparing the way for the release of the product of conception. The basalis undergoes the most marked transformation, and here the egg is inserted and the placenta is situated. Gentili has shown that the decidua possesses qualities similar to those of the glands with internal secretion. Its structure, therefore, is intimately associated with the placenta, and the description of the two will be combined.

#### PLACENTATION

We have learned how the ovum attaches itself to the uterine mucosa by growing through the epithelium into the stroma. At this time it probably has passed the morula stage into the blastula stage, and although it cannot be proved, probably there exists at this time an outer ectodermal layer with syncytial characteristics, i. e., a trophoblast. At this time, also, and certainly within a few days, there

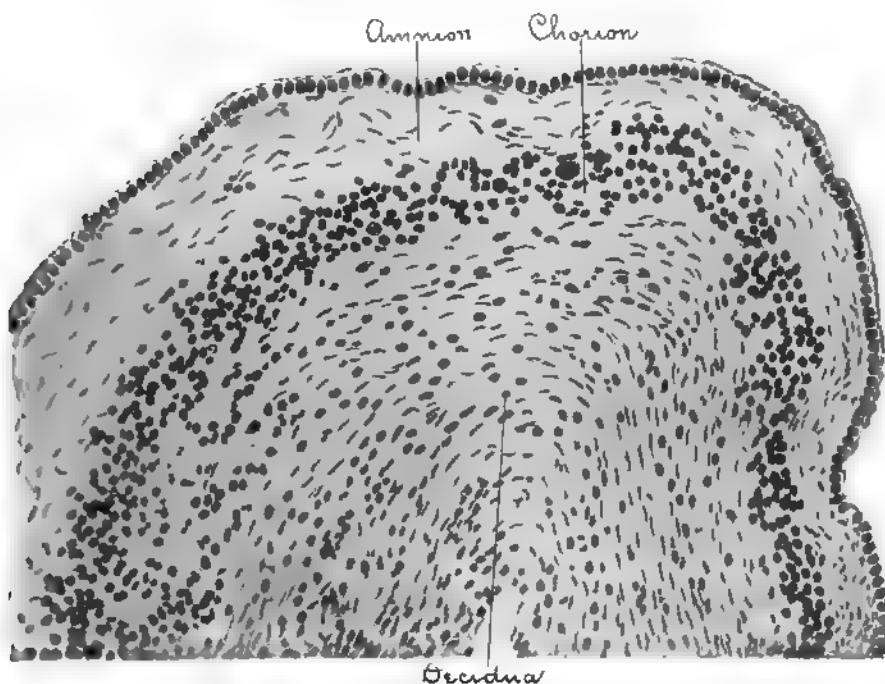


FIG. 47.—DECIDUA VERA AT TERM (high power).

at the three layers of the ovum—the ectoderm, the entoderm, and the mesoderm. The amniotic cavity also is formed, because one of the youngest human eggs, Peters', whose age is estimated at about fifteen days, shows this. The ectoderm is split to form the amniotic cavity (Fig. 61), the outer layer forming the trophoblast, the inner layer sinking toward the center of the ovum, and, with the central mesoderm and entoderm, forming the embryo. While the trophoblast grows into the decidua in all directions, the mesoblast grows out underneath it, and blood-vessels with connective tissue spread out in the latter, coming from the body stalk of the embryo. As we have a condition represented in Figs. 63 and 64.

The trophoblast sends finger-like processes, called villi, into the decidua, the ends of which are dissolved and absorbed, as if by the action of an enzyme (Bryce Teacher), and perhaps used in the nourishment of the ovum. These villi are at first solid masses of cells, and they break into the dilated and new-formed capillaries, pushing the endothelium before them, and destroying it. (See Plate opposite 40.) The maternal blood now bathes the outside of the trophoblast, and by its

action changes the superficial layers of epithelium into syncytium (Peters), and forms irregular blood-spaces or lacunæ in it. The lacunæ, therefore, are both intravascular and extravascular, *i. e.*, are both dilated capillaries and new spaces formed in the trophoblast, and they are the beginnings of the intervillous caverns soon to be described.

The solid trophoblastic processes or villi are invaded from the embryonic cavity by mesoblast carrying the blood-vessels, and thus typical chorionic villi with

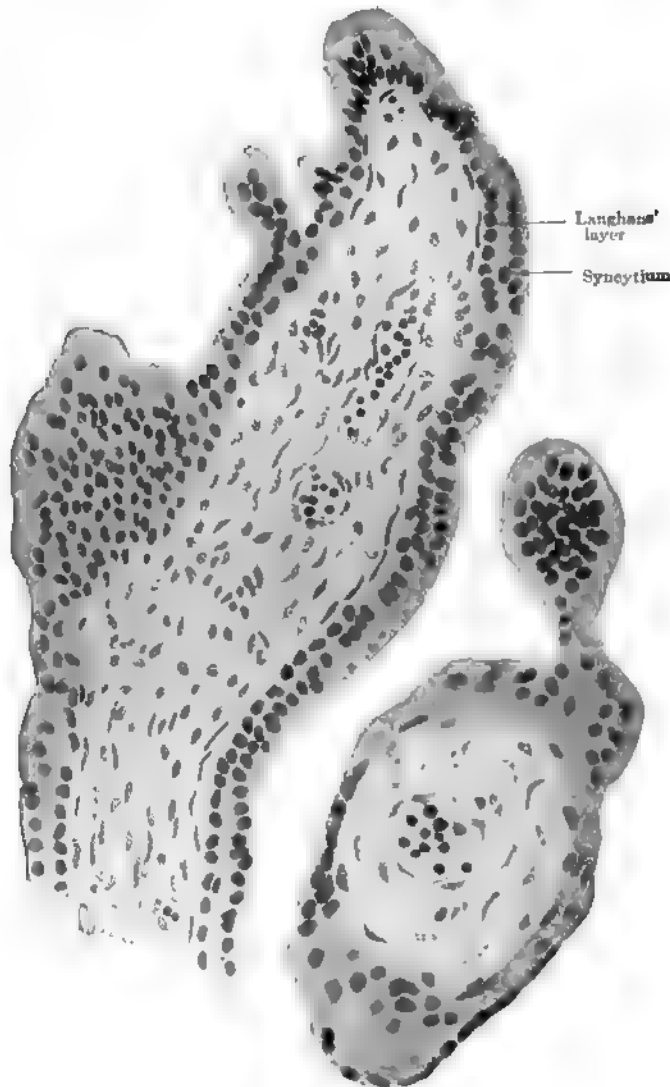


FIG. 48.—CHORIONIC VILLI—THIRD MONTH.  
Compare with hydatid mole, Figure 481.

inner core of mesoblastic tissue, and a covering of trophoblast, in which two layers can early be distinguished, are formed (Figs. 48-50). The outer layer is a stratum trophoblasticum, consisting of a syncytium of protoplasm without cell-walls and with numerous large oval nuclei, the syncytium. In places this syncytium is massed. Underneath is a layer of low cuboid mesodermal cells, which take the stain better—the Langhans layer. Langhans, in 1882, proved that there were two layers, and the lower one is named after him. Preparations fixed in Flemming's mixture show the syncytium to be covered

stiff processes. The function of these processes is unknown. In the villi at term these are low, almost indistinguishable, and the layer of Langhans also has nearly all disappeared. The stroma of the early villus is made up of a reticulated substance, fibromucoid, spindle, or star-shaped cells, separated by spaces resembling lymph-spaces. There are also large vacuolated cells, often containing fat-globules distributed through the stroma (Figs. 48 and 49). These cells probably are much concerned in the biochemic changes occurring in the placenta. In the later and more developed villi, and in the trunks of the villi, fibrous tissue preponderates in the stroma. In the stroma lies a mesh of capillaries, fed by an arteriole and emptied by a venule. These blood-vessels are found as early as the second week, and are brought with connective tissue from the body stalk of the embryo communicating with the aorta. Thus it is seen that, from the start, the circulations of the mother

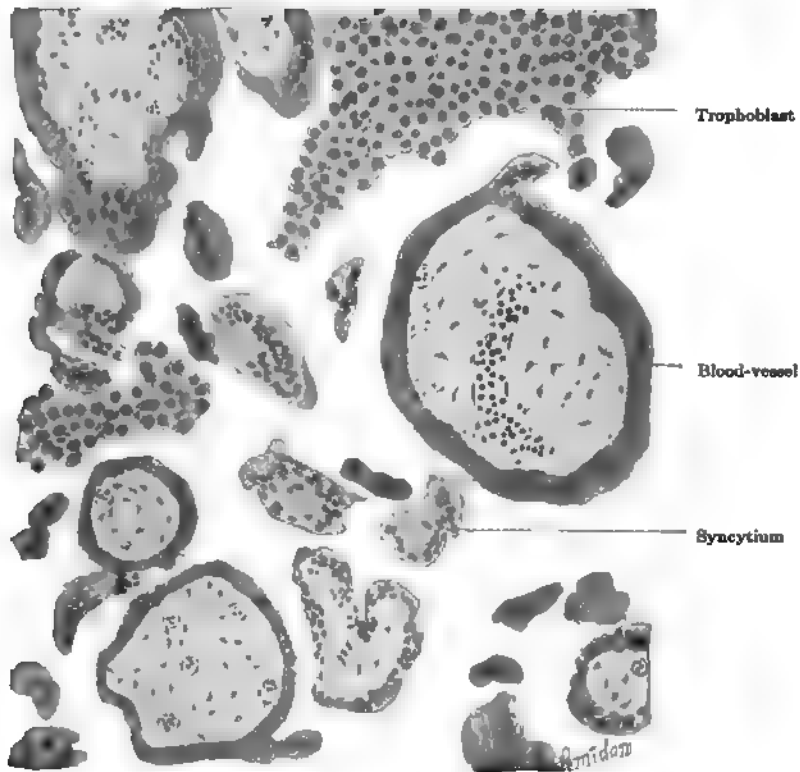


FIG. 49. —SECTION OF PLACENTA, SECOND MONTH.

and the fetus are distinct and do not intermingle. The blood of the child circulates inside the villus; the blood of the mother circulates outside, around the villus (Fig. 54). As the ovum grows the villi increase in number and complexity. They branch again and again, forming long tufts, and soon the whole surface of the chorion is covered by a thick fur of villi (Fig. 50). Those villi that grow toward the reflexa, or capsularis, find scant nourishment, and, too, a decidua that is being stretched and undergoing necrosis, wherefore they also soon atrophy and disappear. The process is started in the fourth week and is finished by the ninth, but sometimes villi persist in the capsularis, forming a reflexa placenta. The basalis is very richly supplied with blood; indeed, its structure is almost cavernous, and the villi here take on luxuriant growth (Figs. 50a and 51). This is the future placenta or chorion frondosum. The atrophied chorion is called the chorion laeve. In the first weeks of life the ovum is firmly embedded in the uterine wall; then, owing to the rapid growth of the villi and their loose attachment (but still, attachment) to



the dilated, newly formed blood-vessels, it is possible easily to lift the ovum out of its bed. Early abortions then give us specimens as in Figs. 50 and 50a. There are in such cases many villi and pieces of villi still remaining adherent to the basalis. These are called anchoring villi, because the syncytium on them has burrowed deeper into the decidua, and sometimes even has pierced into a dilated vein at the site of the placenta (Fig. 52). The villi continue to multiply, growing into the decidual base, which also grows outward among the tufts of the villi. These outgrowths of decidua carry the arteries and veins of the uterus, and in the ripe placenta are represented only by thin partitions between the large lobes or cotyledons of the placenta. The arteries pursue a

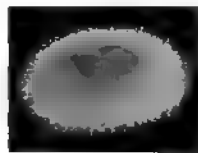


FIG. 50.—THREE WEEKS' OVUM (natural size).

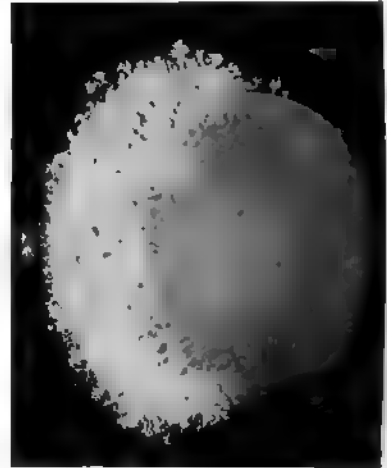


FIG. 50a.—SIX WEEKS' OVUM.

spiral course through the uterine muscle, the basalis, and the septa, while the veins are straight. As these vessels approach the placental site they lose all their coats save one layer of endothelial cells, forming large sinuses, really not distinct vessels, between the muscular lamellæ and the decidua.

We have seen how the villi come to dip into the maternal blood, which flows in

lacunæ formed by the dilated capillaries and cavernous spaces in the periphery of the trophosphere. The rapidly growing villi invade these blood-spaces, which, of course, communicate with those in the decidua basalis, and, finally, as the result of compression and absorption by the trophoblast, the compacta is nearly all destroyed, the villi lying against the spongiosa and a few (anchoring villi) dipping into it. The villi grow in the direction of the venous openings and away from the arteries, the bloodstream naturally swimming them in this direction. They stretch the venous sinuses, and by pressure necrosis destroy the decidua compacta between the veins until only the septa carrying the arteries are left (Fig. 54). The capillaries and veins of the compacta are developed, as the placenta grows large and heavy, into extensive caverns filled with the inextricably mingled branched trees of villi float-

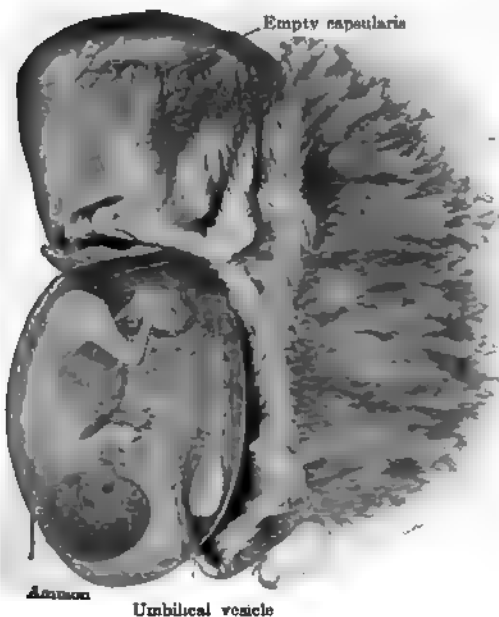


FIG. 51.—NINE WEEKS' OVUM.

The amniotic sac with fetus has escaped from the capsularis.

ing in maternal blood (Fig. 53). These caverns are fed by the arteries which ascend the septa placenta, and are emptied by the veins of the placental site. These vessels may be easily seen on the full-term placenta (Fig. 55).

maternal blood in the intervillous spaces is in constant circulation. The septa bring it, the veins on the surface of the cotyledons empty it, uterine sinuses. The circular sinus also collects the blood from all the

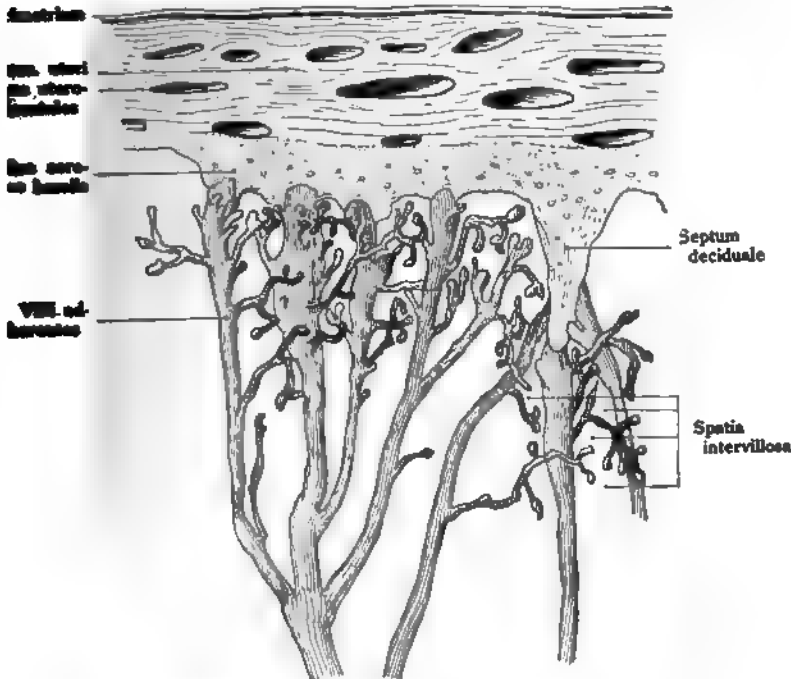


FIG. 52.—ANCHORING VILLI (Kollmann).



FIG. 53.—TREE OF VILLI FROM THREE MONTHS' PLACENTA.  
Drawn floating in water.

cotyledons, serving as an anastomosis. The movement of the blood is aided by uterine contractions which occur at intervals throughout pregnancy.

The placenta grows laterally and in thickness, and about the fourth month

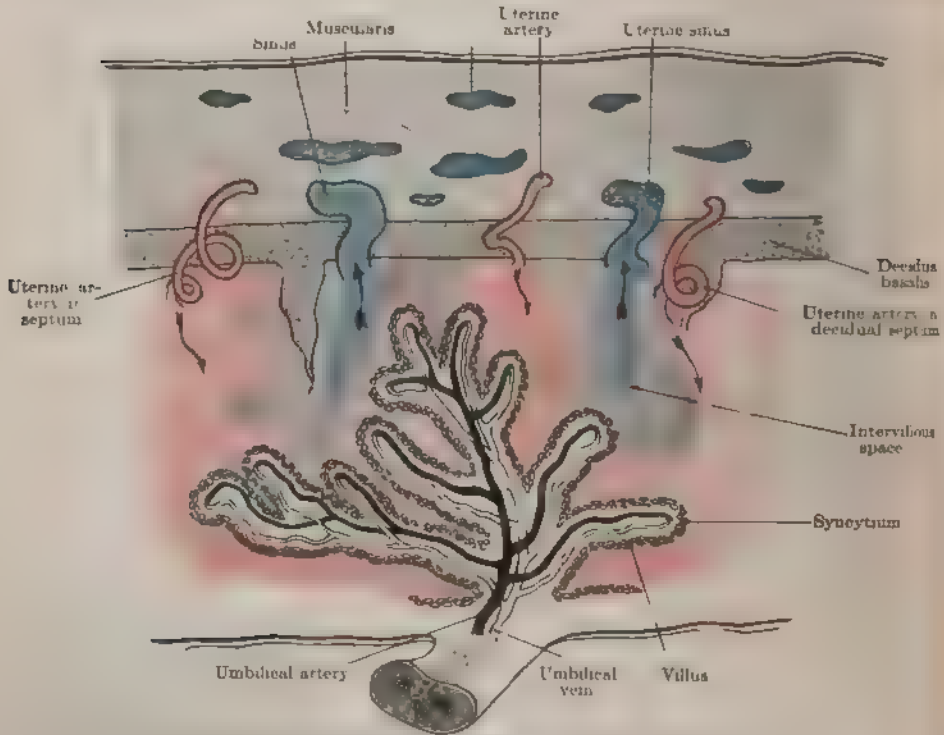


FIG. 54.—SCHEME OF PLACENTAL CIRCULATION (Kollmann, Hand Atlas).  
Arrows indicate supply and exhaust of blood in the intervillous spaces.

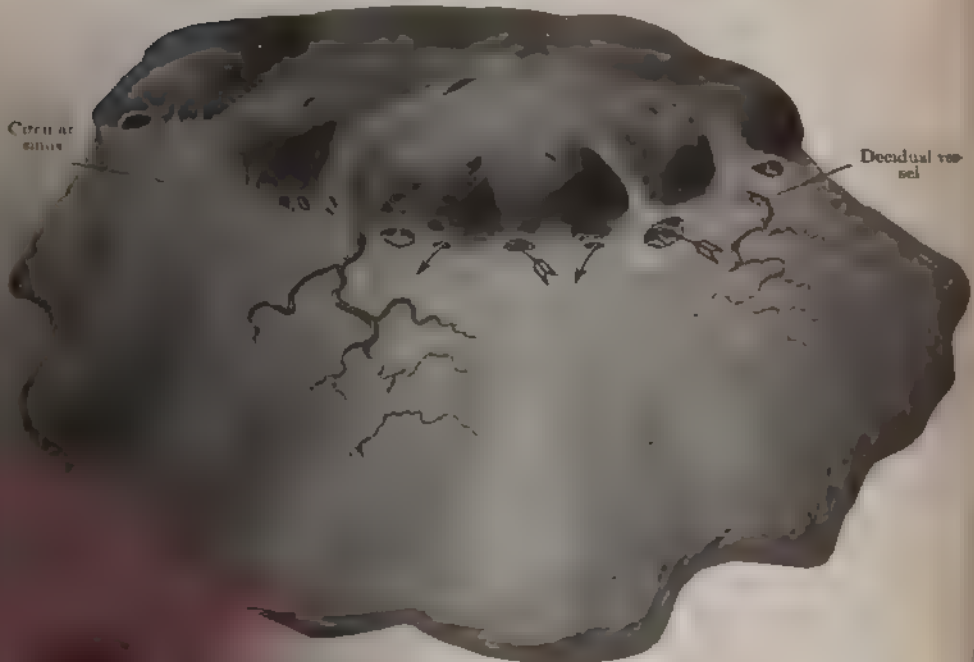


FIG. 55. THE CIRCULAR SINUS OF THE PLACENTA.

es up one-half of the area of the uterus; at the end of pregnancy the placenta occupies one-fourth to one-third of the uterine expanse. Its weight increases at

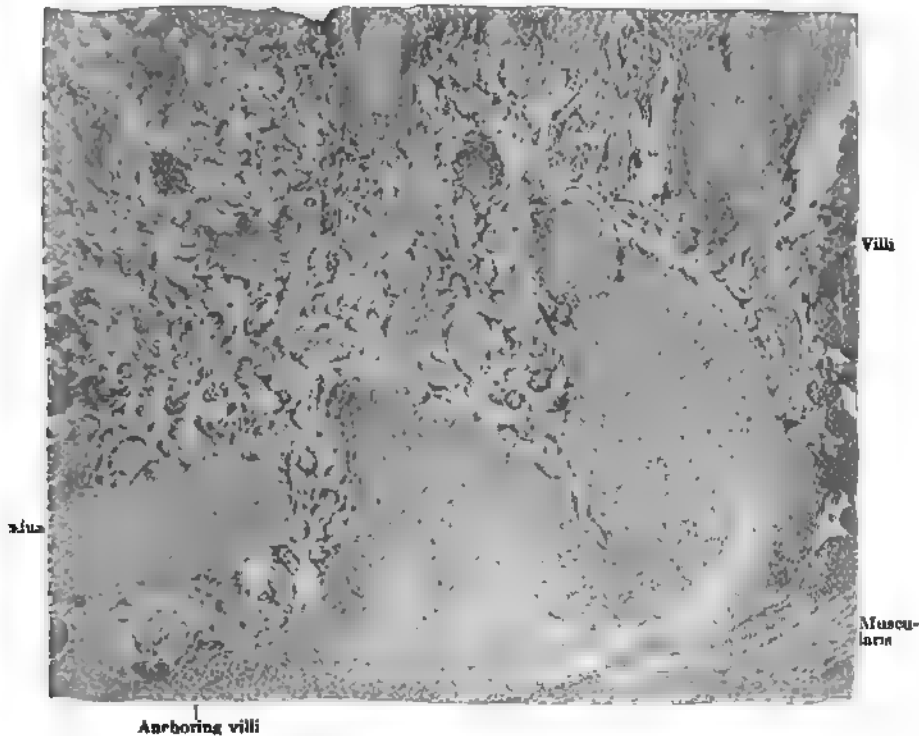


FIG. 56.—DECIDUA BASALIS (low power).

rate of 60 gm. a month until the seventh month, then 50 gm., and, in the tenth month, less than 10 gm. The growth of the villi in the flat is permitted by a lifting of the decidua vera at the periphery of the placenta, and at the same time by an increase of the area of the placental base caused by the growth of the uterus. When the decidua capsularis unites definitely with the decidua vera, there remains a thickened ring of decidua at the junction of the decidua basalis and capsularis, and the periphery of the capsularis atrophying, the villi of the basalis grow, the decidua spreads out under the attached decidua for a short distance. This is exaggerated when there is pathological early adherence of the decidua, or if the natural splitting of the decidua vera is interfered with. The placenta is thus margined and, in marked instances, placenta circumscissæ, are thus produced. The ring of decidua is called the decidua subchorialis. By some it is referred to as the Waldeyer closing ring; by others, the edge of the closing plate of Winkler. The placenta is seen to be com-

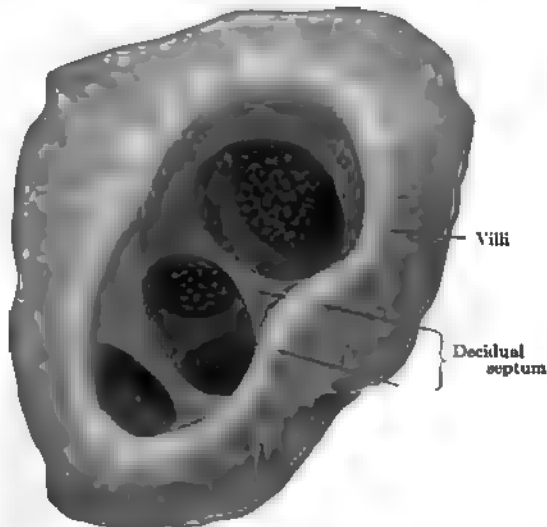


FIG. 57.—VENOUS OPENINGS IN THE PLACENTA (magnified).  
Author's specimen (taken from Kollmann, Hand Atlas).

posed of two parts—one, very minute in quantity, derived from maternal tissues; the other from fetal, both inextricably intergrown.

The two umbilical arteries from the child spread out on the fetal surface of the placenta, divide and redivide, until each cotyledon is provided with a branch.

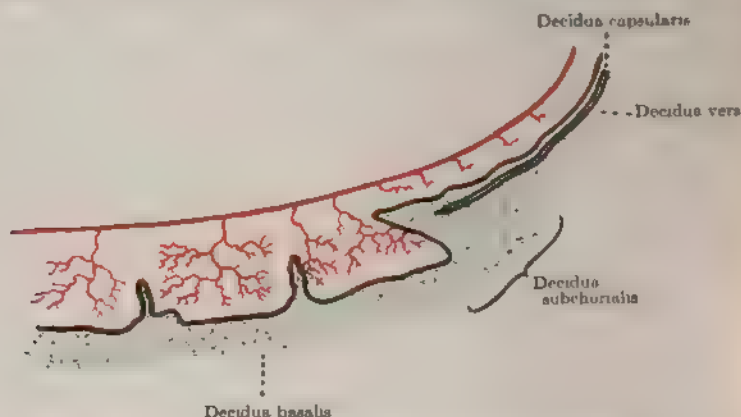


FIG. 58. DIAGRAM SHOWING DECIDUA SUBCHORIALIS (Pfannenstiel).

These branches, which have vasa nutrientia, split up into numerous twigs, and from each twig a bunch of villi hangs (Fig. 53). Each villus is provided with an arteriole

which breaks into a convolution of intercommunicating capillaries. The blood is gathered by a venule to which the venules of the other villi are joined, until large venous trunks are formed which unite on the fetal surface of the placenta to form one large vein,—the umbilical vein,—which passes in the navel-string, the umbilical cord, to the child (Fig. 59). The circulation in the villi is, therefore, absolutely distinct from that of the intervillous spaces, as was proved by William Shippen in 1761, and the interchange of gases, water, and nourishment must take place through the villus-wall, by osmosis and by the vital action of the cells themselves, particularly the latter. The villus-wall consists of the following layers, naming them from within outward: endothelium of capillary, reticular mucoid stroma, Langhans' layer, and syncytium, both of the latter from the fetal ectoderm. Later in pregnancy Langhans' layer disappears or thins out; the syncytial band also grows narrower, until, at term, the villus has only a single layer of the stretched syncytium over it (Fig. 60).

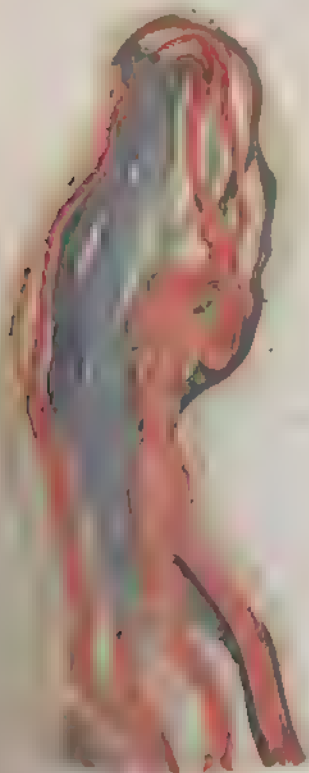


FIG. 59. CIRCULATION OF A VILLUS (from an injected placenta).

A fluid appears in the space between these layers, which is called the exocoelom, and takes in almost the entire content of the egg at this time. By the development of the exocoelom the entoderm is

**The Development of the Amnion and Umbilical Cord.** According to the latest researches of Graf Spee, the amnion in the human is formed in a manner similar to that of many mammals. Very early a split appears in the ectoderm of the germinal area (Fig. 61); this fills with fluid and forces the embryonic plate toward the center of the egg. The mesoderm grows rapidly and separates from the primary amniotic cavity, from the chorionic ectoderm everywhere except at the area of insertion of the body stalk, at the same time itself splitting into two layers—the somatic, external; the splanchnic, internal (Figs. 62 to 64).

rated from the periphery of the ovum and the yolk, or vitelline sac is formed (Figs. 64 and 65). The yolk sac is developed on the abdominal side of the embryo, while the amniotic sac is formed on the dorsal aspect. The vitelline sac, consisting of a layer of entoderm and one of mesoderm, containing albuminoid matter, at first is much the larger; later the amniotic cavity is larger. The yolk sac communicates broadly with the primitive intestinal tube, and has blood-vessels, the vitelline, which convey blood to the embryo. The continued development of the cavity of the amnion and the closing in of the lateral walls of the embryo force the vitelline sac to assume the form of a pedunculated vesicle, and as its contents are absorbed, it shrinks until, at the end of the first week, it is represented only by the slender vitelline duct and the yolk sac (Fig. 81). These structures may often be found on the full-term placenta between the chorion and amnion, more or less distant from the insertion of the cord. The vesicle, which up to the fourth month measures 10 mm., is then the size of a split-pea, yellow and fibrous, and shows, leading from it, lost in the chorion, a fine white thread, the relics of the duct. Schultze's fold is a duplication of amnion (Fig. 66) at the point where the original vitelline duct left the body stalk.

The vitelline circulation ceases as the sac shrinks, and as the embryo receives its nourishment from the chorion frondosum, through the two veins and two arteries of the body stalk (Fig. 66). The amniotic cavity enlarges rapidly, and, coming around the embryo from all sides, causes



FIG. 60.—RIPE PLACENTA.  
a, Intervillous space, b, syncytium.

the appearance of the exocoelom, and forces the body stalk, with its rudimentary blind allantoic sac and the four blood-vessels, and the omphalomesenteric duct together into a single short duct, the beginning of the umbilical cord (Fig. 66). This occurs in the fourth week, and the embryo completely fills the egg in the second month, coming to lie on the chorion throughout its development. The embryo now floats freely in the cavity of the amnion, surrounded by the fluid there called the liquor amnii, and united to the chorion frondosum by the umbilical cord. It is nourished by the blood which circulates between it and the chorion frondosum. The nutritional structures are all formed as they will continue throughout pregnancy, requiring only further enlargement to accommodate the rapidly growing fetus. (For further details the reader is referred to books on embryology. The above description was necessary for the proper study of the various conditions met daily by the obstetric practitioner.) One of the best expositions on human embryology, placentation, etc., will be found in Doederlein's *Handbuch der Geburtshilfe*, 1915, article by Graf Spee.

The placenta at term is a cake-like organ, and weighs about 500 gm., the proportion to the weight of the child being as one to six. Placentas vary in weight, thickness, form, and consistence (Fig. 69). Placentas from large children are heavier. In syphilitic cases the placenta is heavier than with normal children of

the same size, and the proportion may be reduced to one to three. A placenta may be small and thick or large and thin, the usual thickness being  $1\frac{1}{2}$  to 2 cm., breadth 15 to 18 cm. The form is usually irregularly round, but the organ may assume any shape, depending on its direction of growth on the uterine wall (the usual shape is apes), trilobate, and horseshoe shapes are observed.

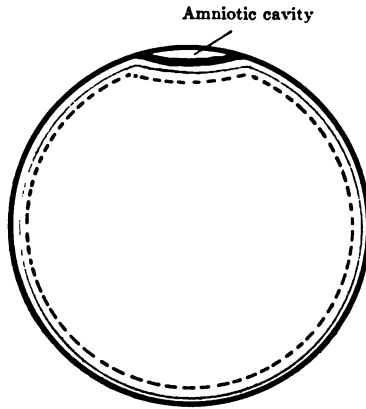


Fig. 61.

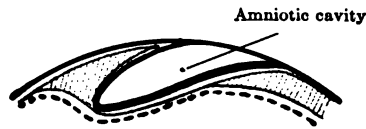


Fig. 62.

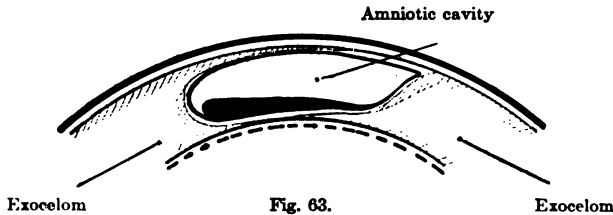


Fig. 63.

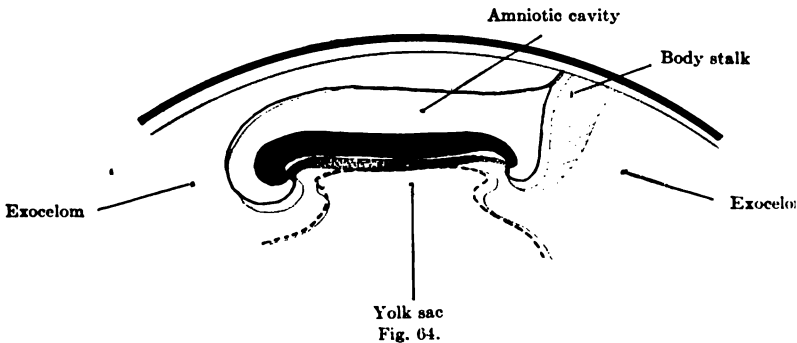


Fig. 64.

FIGS. 61, 62, 63, 64.—DIAGRAMS BY PFANNENSTIEL, TO SHOW FORMATION OF EMBRYO AND AMNIOTIC

the placenta may be spread out over a large area—placenta membranacea. In addition to a main placenta, there may exist accessory portions connected to it by an artery and vein; these are called placenta succenturiata, or, if very small, placenta succenturiata. If no blood-vessels can be seen, the piece is termed placenta spuria. These extra placentas are of immense clinical importance.

If the placenta depends on the first location of the ovum after it enters the

If the ovum attaches itself to the center of either the anterior or the posterior wall, the placenta probably will be round or oval. If it is embedded at one of the lateral angles of the uterus, the decidua, being thin at this point, cannot furnish nourishment to the villi, which then grow eccentrically,—either on to the anterior or on to the other wall of the uterus,—a bilobate or a trilobate placenta is formed. Such a division into lobes may also result from the pathologic formation of fibrous masses in the placenta.

Fig. 65.

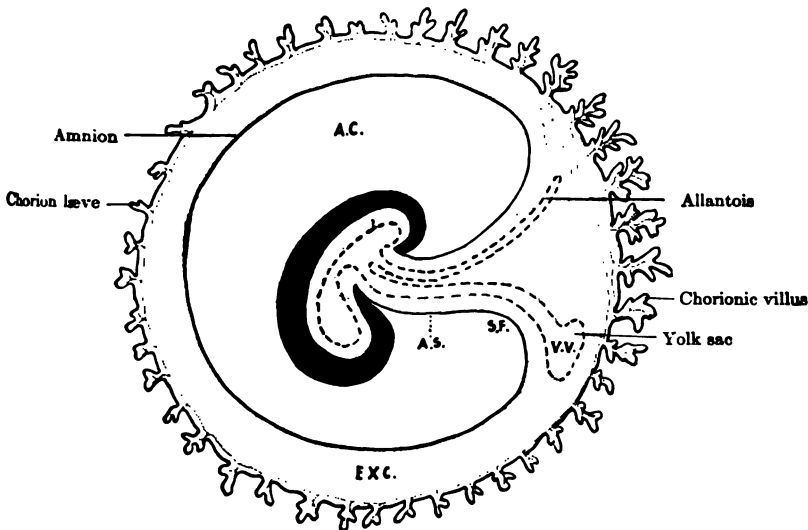
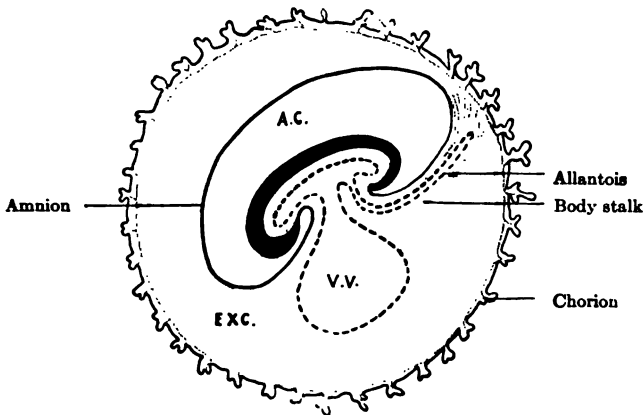


Fig. 66.

FIGS. 65 AND 66.—DIAGRAMS BY PFANNENSTIEL, SHOWING FORMATION OF ABDOMINAL PEDICLE AND ALLANTOIS. A.C., amniotic cavity; S.F., Schultze's fold; A.S., Amnion covering of umbilical cord.

The placentas are soft and very vascular; others are harder and more fibrous, being pathologic. The tissue of the organ is dark red, soft, friable, but when with tough fibrous tissue and blood-vessels. The maternal surface—face which lies on the wall of the uterus—is covered with a thin, grayish, dense, slightly roughened membrane, which cannot be peeled off, but tears from the underlying soft pulp of the placenta. This is that part of the placenta called the *compacta*, and which normally separates from the decidua and comes away with the placenta when it leaves the uterus. This membrane is broken here and there; small bits are absent, and in places it is



thicker and opaque. At the rim of the placenta, and extending a little under amnion, the decidua accumulates, the closing ring of Waldeyer, or the de

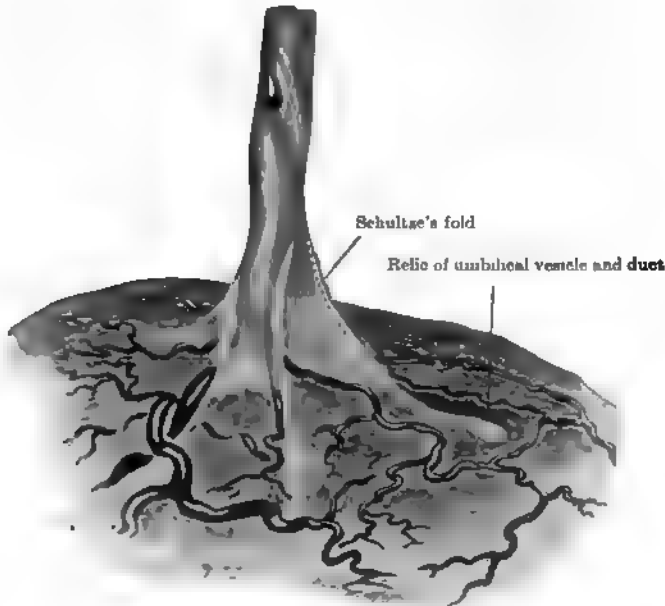


FIG. 67.—SCHULTZE'S FOLD.

subchorialis. If you scrape into this area, you will find a large sinus, the ci or marginal sinus, and it may be followed all around the circumference of the centa. (See Fig. 55, p. 42.)

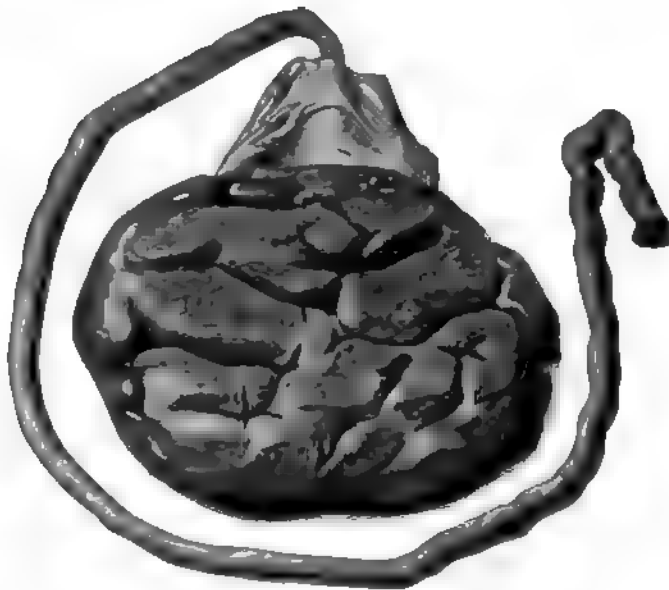


FIG. 68.—NORMAL PLACENTA (MATERNAL SURFACE).

The maternal surface of the organ is divided by decidua septa into num lobes called cotyledons. If one pushes the cotyledons asunder, the sept

and the arterial sinuses which lead into the intervillous spaces are disclosed. (g. 57, p. 43.) Occasionally a cotyledon will be sessile on the surface of the placenta, and may be left in the uterus. The most careful examination of the placenta will fail to discover the absence of such a piece, and serious of the mother may result from its retention, such as hemorrhage or sepsis. The fetal surface of the placenta is covered by the thin, glistening amnion, in which one sees the placental arteries and veins coming from the cord and branching in all directions until the smallest twigs disappear about one-fourth of an inch from the edge of the placenta. The surface is uneven, gray, and reddish, and is dotted with whitish and yellowish areas of fibrous tissue. These are



FIG. 69.—NORMAL PLACENTA (FETAL SURFACE).

white infarcts, are very common, and will be considered under the pathology of the placenta (p. 567). The amnion may be stripped off the fetal surface except at the insertion of the cord. It is attached only by the jelly of Wharton. In rare cases the amnion may be stripped off the cord also, the jelly of Wharton being attached there too. The chorion laeve, that portion of the periphery of the ovum which lay against the decidua capsularis, and in which the villi have atrophied, together with the amnion, forms a veil-like structure hanging from the placenta, and the membranes. The chorion is the outer layer, thicker, cloudy, somewhat translucent, and easily torn. On its maternal surface are the remains of the decidua capsularis, which can be scraped off with the finger-nail as debris. Early

in pregnancy and in pathologic cases it is a thicker membrane. Occasionally one sees blood-vessels running in the decidua, especially in the neighborhood of the placenta. The amnion is tougher and transparent.

The umbilical cord is inserted about the middle of the placenta, but it may be found at any point—at the edge (*insertio marginalis*) or even in the adjacent mem-



FIG. 70.—BILOBATE PLACENTA WITH VELAMENTOUS INSERTION OF CORD.

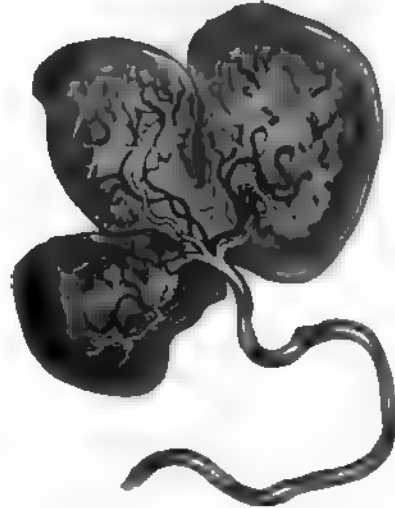


FIG. 71.—TREFOIL PLACENTA.

branes (*insertio velamentosa*). At its insertion are occasionally found small epithelial amniotic growths or caruncles, also the fold of amnion, carrying the ductus vitellinus, *Schultze's fold*. At some point in the membranes there is an opening through which the fetus passed. This lies usually 10 cm. from the edge

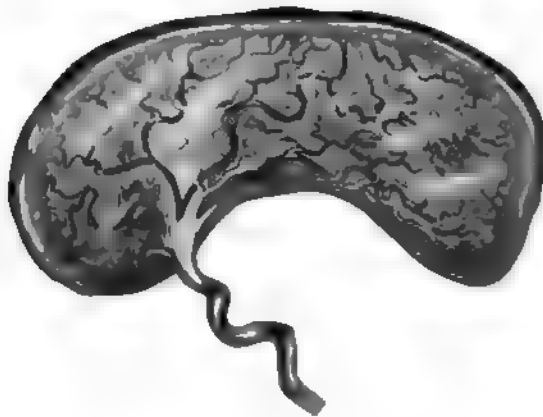


FIG. 72.—HORSESHOE PLACENTA.

of the placenta, showing that such was the distance from the internal os of the uterus to the edge of the placenta. The opening may be close to the edge, which shows that the placenta lay near the internal os, or even over it—*placenta prævia*. The placenta is situated usually on the anterior or the posterior wall of the uterus, seldom over the internal os (*placenta prævia*), and most rarely in the fundus. It

may lap over from one side to the other. The causes of particular insertions of the placenta are unknown. Endometritis and subinvolution certainly have something to do with the location of the placenta low in the uterus.

The umbilical cord connects the fetus with the placenta, and is the means of conveyance of the fetal blood to and from the latter. It is formed by the abdominal pedicle of the embryo, as was described on p. 45. The amnion, as it develops, surrounds the cord, but is not attached to it. This occurs later. On cross-

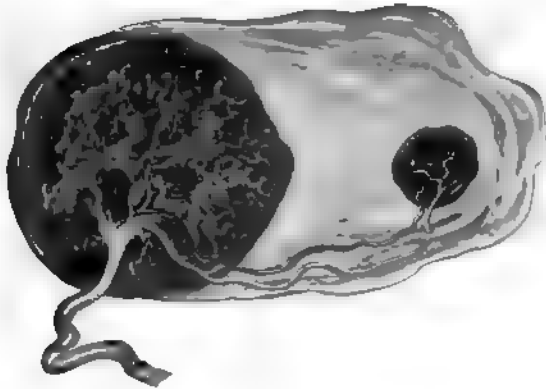


FIG. 73.—PLACENTA SUCCENTURIATA.

section the cord shows the covering of amnion epithelium, two arteries (sometimes one) and one vein (sometimes two), the relics of the vitelline duct (often lost), remains of the allantois, and the jelly of Wharton, which binds all together. If there is much jelly of Wharton, we speak of a fat cord; if little, of a lean cord. The amnion, with its pavement epithelium, passes over into the skin of the fetus at the navel, where there is a sharp line of demarcation between them. A plexus of capillaries ascends the amnion for one-eighth of an inch, but there are no blood-

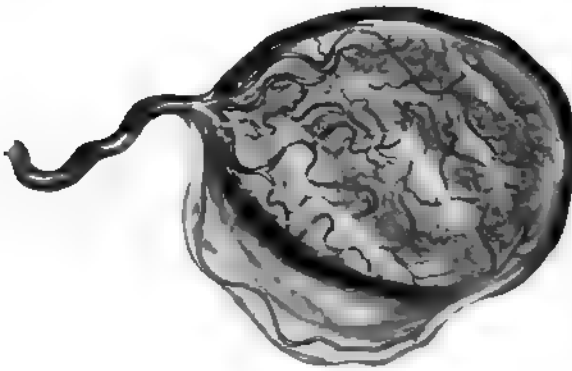


FIG. 74.—BATTLEDORE PLACENTA.

vessels in the cord except those mentioned. Vasa propria do not exist here, but they do in the vessels of the placenta. Nerves were not found by Virchow and most searchers, but Kölliker and Valentine found them. At first the cord is very short, but as the child grows it lengthens until, at term, it measures about 50 cm. It varies from a few millimeters to 300 cm. A length of over 100 cm. is very rare. The spiral twists in the cord, of which there may be several hundred, are explained by the movements of the child, but the direction of the growth of the arteries, and the effect of the pumping action of the fetal heart, may be partly

causative. Stowe found that the tensile strength of the cord was from 8 to 1 pounds.

The umbilical arteries are continuations of the hypogastric vessels; the vein comes from the umbilical vein. The arteries are twisted on themselves; they are twisted around the vein, and the vein is also twisted, and, as a result, there seem to be valves in the vessels, called *valvulae hobokenii*. The arteries usually anastomose near the placenta. In 6 per cent. (Hyrtl) only one umbilical artery exists. They have a strong middle coat. The arteries and vein are sometimes curled in nodes which, covered by the jelly of Wharton, form the so-called false knots of the cord. True knots are also found.

**The Amnion and Liquor Amnii.**—The thin, transparent, silvery, tough membrane lining the chorion laeve and frondosum (placenta) is the amnion. Its formation has already been considered. It is now being successfully used in skin-grafting. (See p. 44.) Occasionally a little of the jelly of Wharton exists between the two structures. The liquor amnii is produced by the amnion at the very earliest period of fetation, and at first it is crystal clear; later it becomes more opaque. The amount at full term varies from 500 to 2000 gm., depending on

many conditions, one of which is the size of the child, another multiparity—more liquor in each instance. Quantities less than 500 gm. and more than 2000 gm. are pathologic, the former being called oligohydramnion, the latter polyhydramnion. The amount of the fluid increases up to the seventh month from then on it regularly decreases until, at term, there is usually enough to fill out the spaces between the irregular contour of the fetus and the uterine wall. It is a clear fluid more or less milky from suspended particles of vernix caseosa. This contains the accumulated and exfoliated epidermis, sebaceous matter, and lanugo from the skin of the child. There are also some leukocytes and unclassified cells. If the fetus dies, the liquor amnii becomes blood stained, and

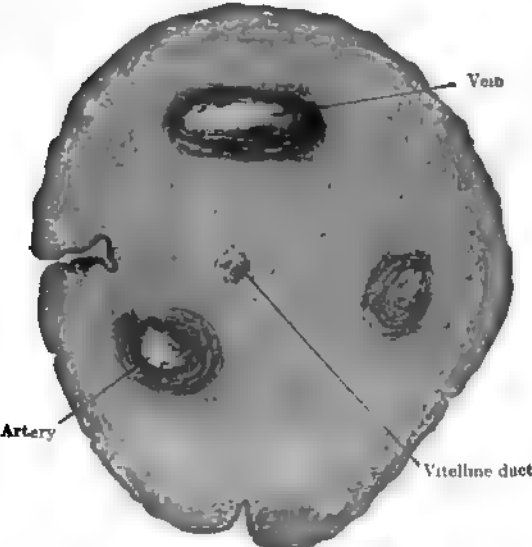


FIG. 75.—SECTION OF UMBILICAL CORD AT TERM.

the child is asphyxiated, one finds it green and thick from the admixture of meconium. It has a peculiar sperma-like odor, and a specific gravity varying from 1006 to 1011 which diminishes as pregnancy advances. The reaction is faintly alkaline or neutral. The cryoscopic (freezing) point of the liquor amnii is slightly higher than that of the maternal blood ( $\Delta = 0.56$ ). Therefore, speaking generally, the liquor is destined to be absorbed (Keim). Clinically, one can observe fluctuations in the amount of liquor amnii. At the seventh month a sudden increase may often be noted.

The chemic analyses of liquor amnii vary considerably. Prochownik found the following:

ANALYSIS.	SPECIFIC GRAVITY	ALBUMIN.	FATS.	INORGANIC.	WATER.
1st.	1081.5	6.81	0.30	6.27	986.62
2nd.	1006.2	7.70	0.10	5.50	986.09
3rd.	1007.1	8.20	1.22	5.68	985.30

Sandmeyer examined the liquor amnii with a view to determining its food value, and found contains an average of 0.22 per cent. of albumin. The salts are in about the same proportion as man blood-serum, i. e., 0.5 per cent., and are the chlorids, phosphates, sulphates, and carbonates sodium and calcium, with very little potassium.

An important finding is urea, which was found by Prochownik as early as the fourth week, and which increases toward the end of pregnancy and with the size of the fetus. The amount varies from 0.02 to 0.4 per cent. Ahlfeld, in a case where the bag of waters had ruptured thirty-days before labor, could find so little urea in the collected liquor amnii that it could not be measured. Barnes says that since there is urea in the egg, the fetus must excrete it.

The albumins in the liquor are serum-albumin, globulin, and an ovovitellin-like substance (Joenner).

Bondi found pepsin, a diastatic ferment, a fat-splitting ferment, and one like fibrin-ferment the liquor amnii. These facts are important in connection with the maceration of fetuses after they die. In diabetes sugar is present in the liquor. Normally, bacteria are not present, but under pathologic conditions they may wander up the cervix and through the membranes, or through the musculature from adherent adjacent organs, e. g., inflamed bladder and appendix or composing fibroids.

*The Sources of the Liquor Amnii.*—Naturally, the liquor amnii comes ultimately from the mother, but much discussion has arisen as to whether the fetus excretes it, either as urine or through the cord and fetal placenta, or whether it passes directly into the cavity of the uterus through the maternal vessels. Probably both hypotheses are true. In favor of the first theory have been adduced—(1) Constant presence of urea in the liquor amnii (the fetus urinates into it); (2) demonstration of urine in the bladder of new-born children; (3) the occurrence of polyhydramnion when the fetus has heart disease, in unioval twins, and in fetal monsters. In the other, however, one must remember that monstrosities are frequently caused by amnionitis, which may also cause the polyhydramnion.

The theory that the liquor amnii is a transudate from the maternal vessels is most plausible. When potassium iodid is given the mother, it will appear in the liquor amnii, but not in the fetal kidney (Haidlen). In diabetes sugar appears in the liquor amnii. (2) When the mother has heart disease or any affection attended by dropsies, one will often find an increase of the fluid. Early in pregnancy, and when the fetus has been dead for some time, there is relatively too much fluid in the uterus. (4) Wohlgemuth and Massone experimentally showed that diastase in maternal blood appears in the liquor amnii when the fetus is dead. (5) Polano believes the liquor is a secretion of the amniotic epithelium, and since pathologic changes in the amnion have not been found in cases of hydramnion, color is lent to this view. That the fetus urinates into the liquor amnii is improbable. If urea was excreted in this fashion, more of it should be found, and it is unreasonable to suppose that nature would have an individual floating in and drinking its own urine. Cohnstein and Zuntz have proved that the arterial pressure in the kidney is too low for the production of urine. Ahlfeld proves almost conclusively that the fetus does not, normally, urinate into the liquor amnii; that when this does occur, it is accidental, and probably due to some more or less serious circulatory disturbance. (See Wagner.)

In a case where I administered methylene-blue to the mother before labor it was excreted by a new-born child in the urine for several days after birth, but the liquor amnii was not blue.

*The Uses of the Liquor Amnii.*—The fluid around the child has most important functions: 1. First it is a food, which the fetus drinks. This is proved by—(a) The finding of lanugo in the meconium after birth, and real swallowing motions have been determined in the fetus during the latter months of pregnancy. (b) In a case of occlusion of the gullet the fetus was atrophied. (c) The liquor amnii contains albumin constantly, and if the fetus drinks enough, it will get a considerable amount of albumin.

2. It is a water-cushion taking up the shocks from external injury, and allowing free motion to the fetus; this prevents deformities, e. g., club-foot. In cases where the liquor is very scant the child is folded compactly together, and shortening of the muscles, wry-neck, and various distortions of the extremities result.

3. It prevents the amnion from adhering to the fetus and causing deformities, e. g., harelip, hemicephalus, amputations, imperfect closure of the body cavities, all examples of arrest of development due to strands of amnion, called Simonart's bands. It preserves the cord from pressure and renders the movements of the child less painful to the mother.

4. During labor it—(a) Helps dilate the passages by forming a fluid wedge with the membranes, and (b), surrounding the fetus completely, it distributes, as all fluids do, the compression exerted by the contracting uterus, equally in all directions, and thus saves any part of the fetus from injurious pressure. When the liquor amnii has been discharged, the fetus is exposed to this pressure and may succumb to it. By the same action the placenta is held against the uterine wall. (c) It washes out

the vagina for the passage of the child, and by its slightly bactericidal action, vents infection of the child and the uterine cavity. Unfortunately, this antis action is weak.

THE FETUS AT DIFFERENT PERIODS OF DEVELOPMENT

At no time of life is the growth of the individual as rapid as it is during the period *in utero*. From the fifth week the fetus doubles its length five times, and its weight is 800 times greater at term than it is at two months. Fig. 76 shows graphically the length curve, and Fig. 77, the

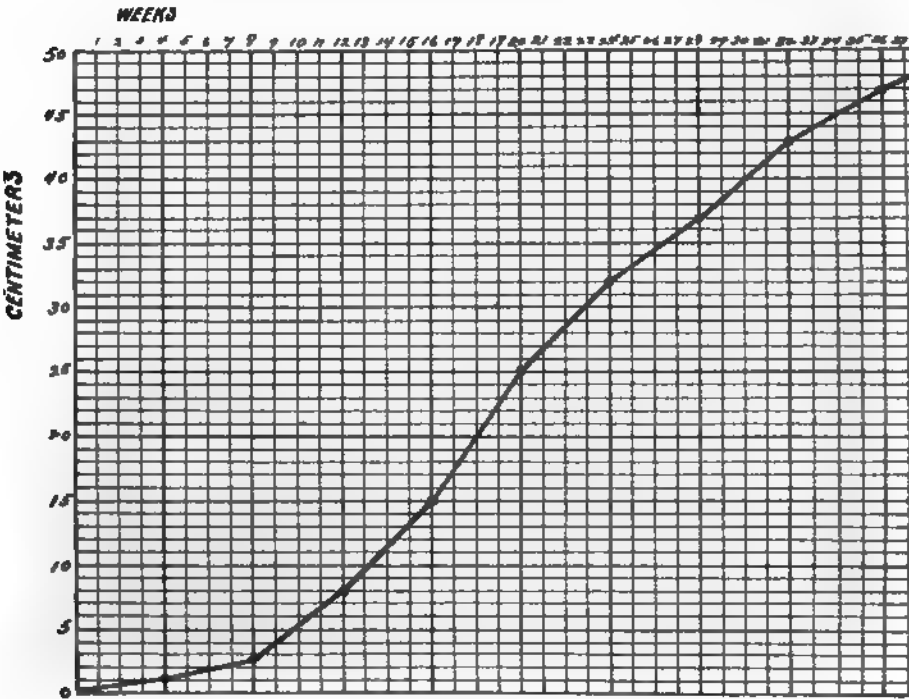


FIG. 76.—CHART SHOWING GROWTH IN LENGTH OF FETUS IN UTERO.

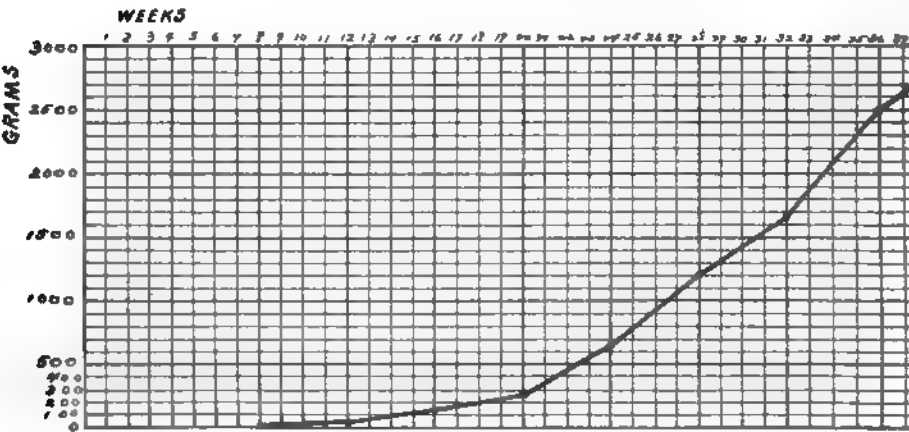


FIG. 77.—WEIGHT CHART OF FETUS IN UTERO.

curve, of the fetus. It is impossible to obtain these figures with scientific accuracy, first, by the exact date of conception cannot be determined in any of the cases, and, second, the individual vary *in utero* as they do after birth. A good rule, which for practical purposes will suffice for determination of the length of the fetus at a given period of pregnancy, is this: Square the nu

of the month, which will give the length of the fetus in centimeters until the fifth month. After the fifth month add to this five each month; thus at four months a fetus should be about 16 cm. long; at six months, 30 cm. ( $5 \times 5 + 5$ ); at seven months ( $5 \times 5 + 5 + 5$ ), and so on. The length of the fetus is the safest guide in the determination of its age. Children vary both in length and weight. Some babies grow faster than others, and too their growth may be interrupted temporarily during pregnancy. Frequent examinations during gestation will show this.

**The Fetus at Various Periods.**—Among the best works on the early human ovum is that of His, and from his "Atlas der Anatomie menschl. Embryonen," Leipzig, 1882, the following pictures are taken (Figs. 78 and 79). His distinguished three periods in the life of the child—the ovular, during the first two weeks; embryonal, the third, fourth, and fifth weeks; and fetal, from that on until term. The ovum in the first weeks interests the practical obstetrician little, because it can be studied only with a microscope. It is almost impossible to judge the age of the little, shaggy, bladder-like ova that are expelled in early abortions, because they are often pathologic. As a general rule, however, an ovum the size of a pigeon's egg is four weeks, and one the size of a hen's



FIG. 78.—EARLY EMBRYOS (from His).



FIG. 79.—TWO EMBRYOS, ONE ABOUT ELEVEN WEEKS, THE OTHER, FIFTEEN TO SEVENTEEN WEEKS.

egg, six or seven weeks. After this period the length of the fetus from nape of neck to sacrum, and still later the total length, or better the sitting height, give more certain conclusions.

**End of the First Lunar Month.**—An embryo of this period is 2½ mm. long. The yolk sac is still prominent and a distinct umbilical cord has not yet formed. There are no external indications of the eye, ear, or nose, although a mouth and primitive jaws exist. Buds representing the extremities appear during the following week. The visceral arches are distinct; the heart is a bulging, flexed tube lacking its characteristic chambers; the blind intestinal canal still opens rather broadly on the yolk sac; the first indication of the liver appears, but the kidney is undeveloped.

**End of Second Month.**—The fetus is 3 cm. total length; the branchial arches are prominent at the beginning of this period, but disappear at its end. The nose, ear, and eye are present, although the eyelids are still fused. The extremities, at first bud-like at the end, show the division into three parts: first, the arm, forearm, and hand; then the thigh, leg, and foot, and the digits are more marked. The tail-like process has disappeared. The navel begins to close; the liver develops, also the abdomen, which is not yet quite closed, and the external genitals appear, but it is impossible to determine the sex of the fetus, since the male and female genitalia are developed from identical organs and are differentiated later.



The villi in the decidua serotina grow luxuriantly, forming the future placenta, the permanent fetal maternal relations being now fully established.

*End of Third Month.*—The ovum is a little larger than a goose-egg, and the fetus 9 cm. long, weighing 5 gm. at the beginning and 20 gm. at the end of the month. The navel is closed, the internal genitals differentiated. The external genitals are alike in the two sexes. At the beginning of the eleventh week the scrotum closes, and the sex may be determined. The intestinal canal is formed and contains bile (Zweifel). The body resembles a human being, though the head is still proportionately extremely large. Centers of ossification are visible in many of the bones.

*End of Fourth Month.*—The fetus is 18 cm. long, and weighs 120 gm. at the end of this period. Meconium is present and is turning green (Charpentier). The muscles are active, fetal movements being occasionally felt by the mother. The heart-beat is strong and has been heard. The external organs of sex can easily be differentiated. The skin is bright red, transparent, so that all the vessels are visible. Lanugo—fine hair—appears on the skin.

*Fifth Month.*—The fetus is now 25 cm. long, and weighs 250 to 280 gm. (7 to 9 ounces). The head is still very large, being the size of a hen's egg, but the abdomen is less prominent. The fetus is lean. The skin is still red, but, owing to the deposition of fat, is less transparent. The lanugo is present all over the body, but on the head there are indications of hair. The nails can be distinguished. The eyelids are closed. Such a fetus may live for five to ten minutes with strong heart-beat and attempts at respiration.

*Sixth Month.*—The fetus, at the end of the sixth month, is 28 to 34 cm. long and weighs about 645 gm. (1½ pounds). Its body is more in proportion, though still lean, the amount of fat in the skin being still small. The skin is wrinkled, and vernix caseosa begins to form. This is the accumulated, exfoliated epithelium and sebaceous secretion. The eyebrows and lashes are formed; the eyelids are separated, and such an infant born, may breathe, though superficially, and live for several hours under favorable conditions. Since its respiratory, digestive, and assimilative organs are undeveloped, no artificial means will preserve these fetuses from congelation and starvation. Reports of the rearing of such infants are to be discredited.

*Seventh Month.*—Length, 35 to 38 cm.; weight, 1000 to 1220 gm. (around 2½ pounds). The infant looks like a dried-up old person, with red, wrinkled skin. The wrinkles fill out with fat and disappear, but in later life or in illness they develop again in the same form and distribution. One can often trace family traits through these wrinkles. The eyes are opened; the testicles sometimes have entered the scrotum. The child cries with a weak whine or grunt, but, since the lungs are not developed, it can seldom be kept alive. Rarely, an infant at seven months of gestation is as far advanced as another at eight months, and can, of course, survive. Those children of the early part of this period which the author has succeeded in raising have in later years not given him much satisfaction, having nearly all become hydrocephalic, dwarfed, or paralytic. From the twenty-seventh to the twenty-eighth week not a few have been saved and are growing promisingly.

*Eighth Month.*—The child is now 43 cm. long, and weighs around 1600 gm. (3¼ to 4 pounds). The pupillary membrane has disappeared. The skin, though still red, is not so much wrinkled, and the child is less lean. Vernix caseosa and lanugo are still present. The testicles are usually in the scrotum. The bones of the head are soft and flexible; ossification begins in the lower epiphysis of the femur. Meconium is passed with difficulty. Crying is stronger, but sometimes only a whimper. Such children may generally be reared, with the aid of maternal milk, good nursing, and a proper incubator.

*Ninth Month.*—Weight, about 2500 gm. (around 5½ pounds); length, 46 to 48 cm. The lanugo begins to disappear from the face and abdomen, the redness fades, the wrinkles smooth out. The panniculus adiposus develops, the limbs become rounded. The nails are at the tips of the fingers. Circulatory, respiratory, and digestive organs are now well developed, though the child requires good care for a successful extra-uterine existence.

*Tenth Month.*—Weight, 3100 gm. (7 to 7½ pounds); length, 48 to 50 cm. Ahlfeld says the fetus may lose a little after the fortieth week. At the end of this period the child is prepared to cope with the factors of an extra-uterine existence. It is "ripe" or "at full term."

**The Fetus at Term.**—A fully developed, ripe fetus presents the following signs of maturity: length, 50 cm.; weight, 3400 gm. (7 to 7½ pounds); the skin is white or pink, a fleshy red denoting prematurity; vernix caseosa is thick in the creases and around the shoulders and back; the hair is several centimeters long; the lanugo mostly gone; the finger-nails are firm and protrude beyond the fingers and to the tips of the toes; the panniculus adiposus is well developed; the milia comedones around the nose have usually disappeared; the chest is prominent; mammary glands project; the navel is at the middle of the belly, and two or three centimeters below the middle of the body (higher in boys than in girls); the testes are in the scrotum; in girls the labia majora cover the minora; the ear projects from the head, its cartilage being well developed; the bones of the head are solid, the sutures narrow; the circumference of the head is equal to or less than the shoulders (Frank), the voice is loud and strong; sucking movements are strong and sustained; meconium is passed early and often.

At autopsy one finds other signs of maturity in the advanced ossification of bones, *e. g.*, the ossification center in the lower end of the femur is 7 to 8 mm. ad, and the cerebral convolutions resemble those of the adult brain. x-Ray studies of fetuses to determine their age I have found unreliable because the appearance of the various ossification centers is not regular, but Hess has found that particular roentgenologic study of the upper extremities, the upper spine and head give data which are useful. von Winckel found the size of the liver and other organs a guide to the age of the fetus. The size and development of the placenta and cord are unreliable indices of maturity. Vascularity of the de-



FIG. 80.—X-RAY OF FETUS, EIGHTH MONTH. LENGTH, 45 CM.; WEIGHT, 3 POUNDS, 8½ OUNCES.

ua at the border of the placenta is usually a sign of prematurity of the ovum, endometritis must be excluded. Ahlfeld found scratch-marks on the amnion made by the fetus after its nails had grown beyond the finger-tips. This might be useful in medicolegal cases to determine, from the secundines, if the puerpera had delivered a viable infant. (See v. Winckel's *Handbuch* for an exhaustive consideration of this subject.)

Not any one of all these signs is absolutely reliable. The most certain is the length of the fetus, but even this varies from 48 to 52 cm., while children of 55 to

62 cm. have frequently been delivered. The weight of the fetus is especially uncertain, as a nine months' pregnancy may produce a child of only 1700 gm. (3½ pounds), while one of eight months may develop an infant of 3840 gm. (8 pounds). Hodge (1850) taught that well-matured children are sometimes born before full term, and Parvin mentions a case of an infant weighing 7 pounds delivered after less than two hundred and twenty-six days of gestation.

Some children at term or over term are small and puny because of general debility of the mother or sickness during pregnancy. A prolonged febrile disease, for instance, typhoid, during pregnancy will compromise the growth of the fetus, as also will chronic diseases, diabetes, heart disease, tuberculosis, the various anemias, and syphilis. Bright's disease is particularly unfavorable, since the placenta is frequently infarcted (le placenta albuminurique) and its nutritional function interfered with.

Diseases and abnormal location of the placenta restrict the growth of the child. The children in placenta prævia are usually undersized. Women with generally contracted pelves often have small babies, thus giving evidence of a hereditary tendency to arrest in development. La Torre finds no difference in size in the children from women with contracted pelves and those with normal pelves, but his observations were mainly on rachitic women. Large muscular women have large babies, and the same is true, to an extent, of the father. The head of the child bears a certain relation to that of the father and mother. Fat women usually have large babies. Women of the better classes have larger infants than the needy poor. Workers in factories have small children, and in some European countries pregnant women are not allowed to work in them during the latter months, many being sent to maternities to rest during the period. This restriction has been enforced even in the face of the demands for women's work by the necessities of war. Statistics have shown a distinct improvement in the general health of the mothers and a gain in the weight of their infants since this practice was instituted. Cigarmakers and workers in lead and phosphorus, if abortion and premature labor do not occur, have puny children. Therapeutically, we try to influence the size of the child by dieting the mother during the latter third of pregnancy. (See Prochownik's diet.) White children are larger than colored, American larger than European, boys larger than girls—3 to 5 ounces. Children born in wedlock are heavier than the illegitimate; this may be due to the attempts to produce abortion which many such women make, to tight abdominal constriction practised to hide the evidence of pregnancy, and to the lack of proper nutrition and care they often suffer.

The children increase in size in successive pregnancies, which is due to the better development of the mother which comes with years, the more active circulation in the uterus, and the prolongation of the later pregnancies. The first child is likely to be small or thin, since it often comes a few weeks before term; the uterus is tense and allows little freedom of movement, and the health of women in their first pregnancy is usually not as good as in the subsequent ones. Statistics seem to show that the first children are less strong physically, and more often become tubercular or insane. The children of later pregnancies, too, are better developed mentally than the first born. Many great men were later children in large families; for instance, Benjamin Franklin was the seventeenth; Napoleon, the eighth; Daniel Webster, the seventh; Wagner, the seventh; Irving, the eleventh; Coleridge, the thirteenth, child of their parents. After the eighth or ninth child a reduction in size is often apparent, due to a decline of the general health. Children from women after a long period of sterility are smaller than usual, and the infants of young girls are generally undersized.

If the child is carried over term, which is not seldom, it overgrows, the head hardens, and the muscles and fat become firmer. (See the chapter on Prolonged Pregnancy.)

The evidences of life of the fetus in utero form an interesting study. The fetal heart can be heard; heart and funic murmurs, too; one can feel the pulsation of the heart through the abdominal wall—all of which will be considered fully under the diagnosis of Pregnancy. The fetus moves its limbs and body from the earliest months, and the movements are audible and palpable from the fifteenth week. When one sees an extremity move under the abdominal wall, and sometimes the child kick out with considerable force. These movements may be so active that they disturb the mother's sleep and require treatment, such as a tight abdominal binder and a dose of sodium bromid. The child has periods of sleep, of rest, and of activity. The mother may notice that the fetus stretches itself after a period of quiet. The author has felt the child flex or extend its head, withdraw its hand when the member is touched, and move out of a strained position into one more comfortable. The infant swallows the liquor amnii in large amounts, lanugo and vernix caseosa having been found in the meconium. These swallowing motions have never been diagnosed. The fetus also sucks its fingers in utero. Ahlfeld reports a case where the child's thumb was swollen at birth, and it immediately put the swollen member in its mouth and sucked it. In face presentation the child will suck the examining finger. One of the most interesting phenomena of intra-uterine life is fetal hiccup. Hermann first described it, but Ahlfeld has worked up the subject. The author has very frequently found it, and many intelligent women have remarked and correctly diagnosed the phenomenon. The movements are short, quick jerks of the shoulders and trunk, 15 to 30 a minute, regular, visible, audible, and palpable to the observer. They resemble hiccups perfectly except the absence of stridor. The author has heard them as early as the fifth month of gestation. They may continue for twenty minutes and become very annoying to the mother, recurring at more or less frequent intervals until delivery. In one case the author heard the lungs distinctly just before the child was born, and within a minute after the child was delivered it was hiccuping so loudly that it was heard in the next room. The contraction of the diaphragm has been felt by the hand in the uterus during the operations of version and extraction, but it was impossible to be sure that the infant was not suffering from asphyxia and was gasping for breath. The latter explanation of such a movement is the first one to be thought of in cases of this nature.

Another phenomenon, not so common, and more uncertain of diagnosis, is the respiratory action of the child in utero. If one carefully observes the umbilical region of a thin woman, pregnant near term, one may discover fine rising and falling movements of the abdominal wall. They occur 60 to 80 a minute, are intermittent, and are most pronounced in the region of the child's chest. Ahlfeld has studied these motions very thoroughly, and is convinced that they are due to minute excursions of the fetal chest, and he has succeeded in getting graphic tracings of them with the cardiograph, showing that when the chest expands, the abdomen contracts. As a support to this theory one may add the daily observations of the newborn child. Inspection of the chest will show, just before the gasp that precedes the first cry, tiny rapid inspirations and expirations. These are best observed on the pneumonic child delivered by cesarean section. The motion in utero serves to strengthen and prepare the diaphragm and chest muscles for the function of respiration, but it is not strong enough to suck liquor amnii further than the pharynx, whence it is probably swallowed.

**The Mental State of the Fetus in Utero.**—A child shows, very shortly after birth, a few evidences of mental action. It turns its face toward the light; it draws the foot or arm away from an obstructing object. The special senses are all present; even if only a few hours old it makes a wry face when a solution of quinin is placed on the tongue; a loud sound causes it to start; it feels pain, and it sees.

The mental condition of the fetus in utero has been the subject of much specula-

tion. That the child lies in a continuous "dreamless sleep" (Parvin) is not probable. Intelligent mothers have said they could distinguish periods of sleep, of rest, and of activity. The child will assume a more comfortable attitude after it is disturbed by external manipulation with movements that are not all reflex. During labor it will wriggle its head away from the examining finger; it will draw its hand away from one's grasp. As Bailey said, it is probable that a vague and obscure will intervenes in the production of these movements.

Palpation of the fetus increases the rapidity of the heart. (For further information on this subject see Peterson and Rainey and Canestrini.)

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ts in the sac, and does its mother's, to the introduction of foreign  
antibodies, by the production of antibodies. It has less complement than the  
mother's blood. The Wassermann reaction is not determinable until the third week.  
The nucleated red blood-corpuscles have all disappeared at the ninth month.  
The red blood-corpuscles are more easily decomposed than the mother's, but  
show increased resistance to hemolysis by cobra toxin. Boys have more than girls  
(8 per cent.). The fetus has a relative leukocythemia, and the number of leukocytes  
in the umbilical vein is greater than in the arteries; wherefore, since the white blood-  
corpuscles cannot pass over from the mother, one must conclude that they are  
made in the placenta.

The hemorrhagic and icteric tendencies of the new-born and its weakness  
against infection show that it has a special blood pathology, but little is actually  
known about it. Its immunities are not yet developed, and, unless it receives anti-  
bodies from the mother via the milk, it succumbs easily to infections.

*The Fetal Circulation.*—The yolk sac has slight nutritive properties; it ac-  
quires a store of nutriment from the mother, and supplies it to the growing embryo  
through two sets of vessels—the vitelline arteries and veins. This is the first, or  
"vitelline," circulation; it is prominent for the first four weeks, and disappears later  
(Fig. 81). With the development of the chorionic villi and the umbilical vessels  
on the body stalk the fetus is provided with a new, rather a more direct, source  
of nourishment. The capillary system of the umbilical arteries and veins rapidly  
invades the growing villi, and thus the osmotic connection between the maternal  
and fetal blood is soon established. Figure 83 shows the vitelline and umbilical  
circulation existing side by side. The fetal blood now passes from the primitive  
heart through the primitive aorta, the umbilical arteries, to the capillaries lining the  
periphery of the ovum, and dipping into the chorionic villi, returning through the

umbilical veins to the heart through the ducts of Cuvier. As the liver develops the blood returning from the chorionic area through the umbilical vein, traverses the liver, but soon, since the vessels of the liver cannot accommodate the rapidly growing demands of the developing placental circulation, a by-pass is formed from the umbilical vein through the liver to the inferior vena cava. Thus the returning blood from the now fully differentiated placenta passes, part through the liver with that from the portal vein, and part through the by-pass, the *ductus venosus Arantii*, into the inferior vena cava. The circulation of the blood

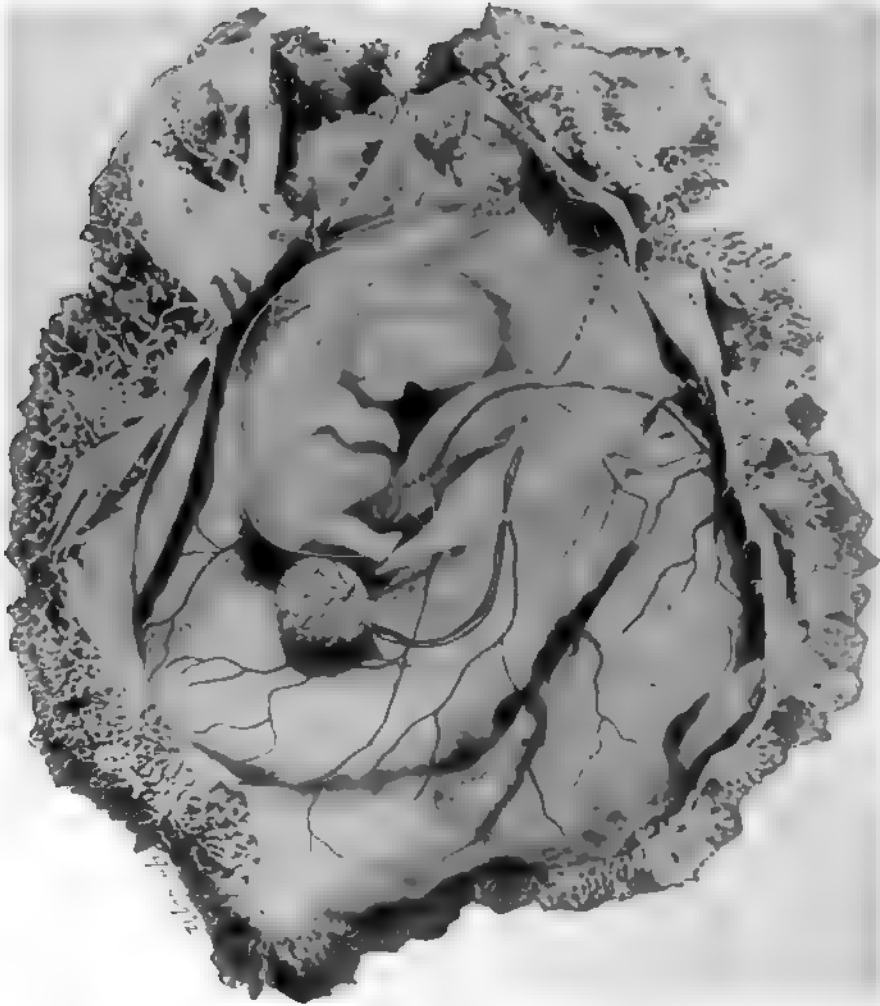


FIG. 81.—THE VITELLINE CIRCULATION (from a specimen loaned by Professor R. R. Bensley, University of Chicago).

in the fetus before birth is different from that afterward, and at no part of the body is purely arterial blood supplied. This is easily seen in children delivered by cesarean section; they present a dull blue color, almost cyanotic.

The blood, oxygenated and cleansed in the placenta, provided with nutritive substances and water for the fetus, is collected by the branches of the umbilical vein and passes through the single vein of large caliber to the child, entering the body at the navel, then ascending behind the parietal peritoneum to the liver. In the liver the vein divides, several branches entering the liver directly, others anastomosing with the portal vein, while one large branch goes directly into the vena cava. The

us venosus Arantii. The blood of the vena cava ascendens is, of course, and mingles with that coming from the ductus venosus, both proceeding to the right auricle, which is entered through the right auricle. Owing to a peculiar arrangement of the endocardium a valve-like fold is thrown up near the opening of the cava, the Eustachian valve,—which directs the blood-stream toward the septum of the right ventricle where an opening exists—the foramen ovale. This communication between the right and left auricles permits the blood from the ascending cava, during cardiac diastole, to pass directly into the left ventricle. The right auricle is filled by venous blood coming from the superior vena cava, and a little admixture of arterial blood admitted by the valvula Eustachii. This dark blood flows into the right ventricle (Fig. 84). When the cardiac systole occurs (Fig. 85), the blood (almost entirely arterial) is forced into the aorta, its cranial branches, and down into the trunk. The venous blood in the right ventricle passes up through the pulmonary trunk, which divides into three branches—one to each lung, and one large branch which anastomoses with the aorta. This by-pass is called the ductus arteriosus, and serves to relieve the functionless lungs of the excess of blood.

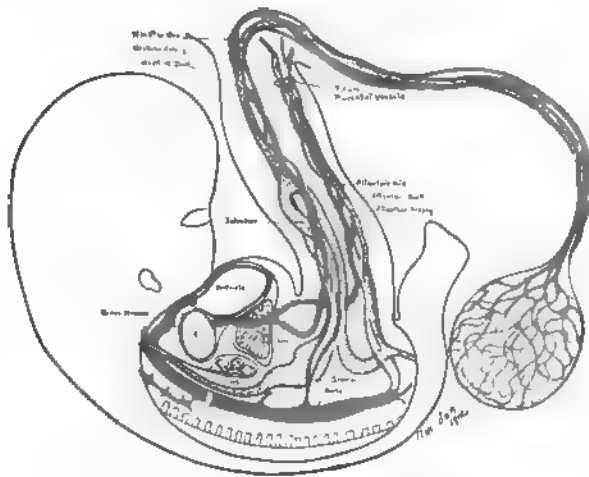


FIG. 82.—DIAGRAM OF THE VITELLINE CIRCULATION.

mm. long, seven weeks' growth. Vitelline circulation completed. Umbilical circulation increasing. Atrium dividing. Liver consisting of two equal lobes. Primitive aortae partly united.

right ventricle throws out. One-half of the blood takes this short cut to

The blood in the arch of the aorta, therefore, is quite arterial, while that sent to the trunk and extremities is mostly venous. Pohlman, however, by his experiments to indicate that, contrary to the generally accepted view, there is a mingling of the blood which enters the right atrium through the inferior vena cava; if this occurs there would be no difference in the quality of blood sent to the various parts of the body. The hypogastric—the former umbilical arteries, leaving the external iliacs in the pelvis, ascend alongside the bladder and pass up to the navel, then, winding spirally around the umbilical vein in the sheath of the placenta. Here they split up into arterioles and capillaries in the placenta. The fetal blood contained in the placenta is constantly undergoing the changes that in the adult occur in the lungs, the liver, the blood-making and other organs of the body. The peculiar distribution of the fresh blood in the fetus accounts for the variation in the growth of its organs. The liver, receiving the blood directly from the placenta, grows massively, and is thus able to perform its important functions in fetal life. The head receives the blood next in freshness, the trunk and extremities receive the poorest blood. Late in pregnancy the position of the vena cava inferior moves over to the right of the auricle, and the



foramen ovale begins to diminish in caliber; thus the right auricle receives less blood, and more blood is forced into the lungs and through the ductus arteriosus in the lower portion of the body. A more equable distribution of nourishment is effected, and greater symmetry of the body results.

After the birth of the child important changes in the blood-currents occur. With the first inspiration the lungs expand. The pulmonary vessels are dilated and blood rushes into them from the right ventricle. Since the lungs now take all the supply from the pulmonary artery, the by-pass to the aorta, the ductus arteriosus Botalli, collapses and shrinks up. It is solidly obliterated in a few weeks. The aspiration of the right auricle and ventricle draws the blood from the umbilical vein

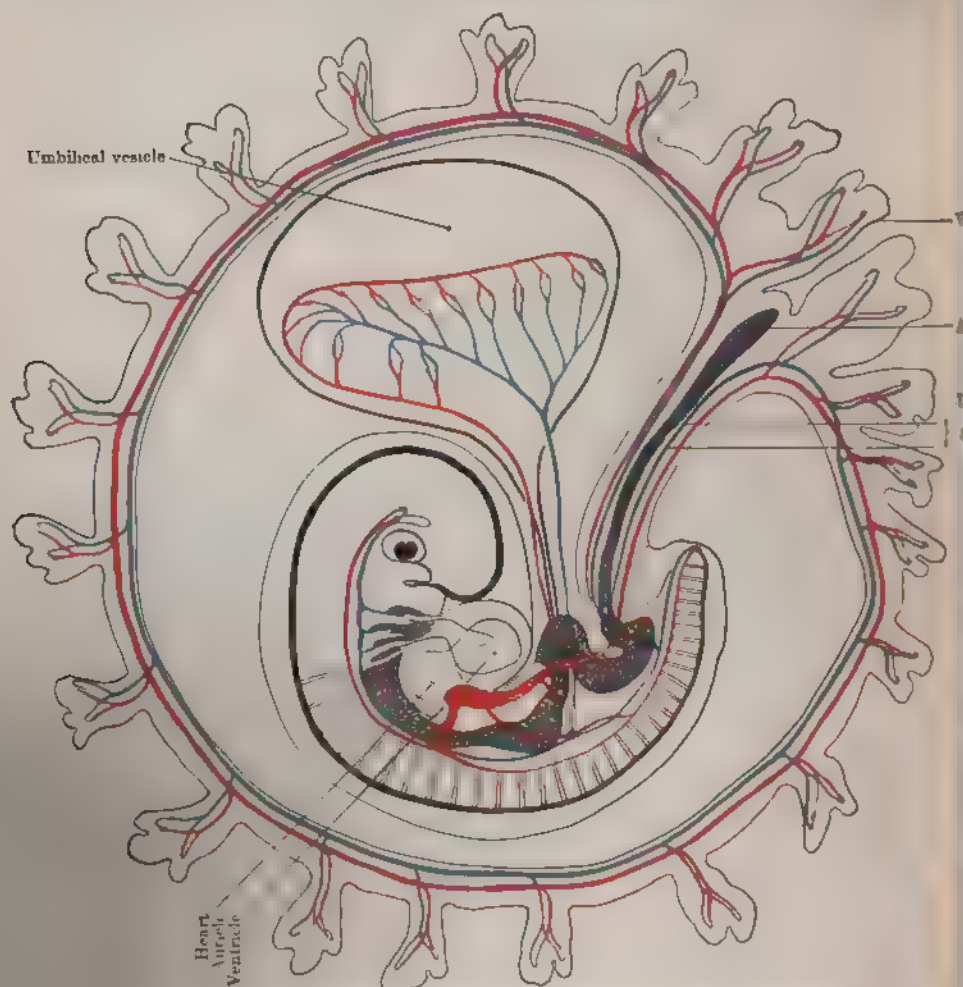


FIG. 83. SYNCHRONOUS VITELLINE AND CHORIONIC CIRCULATIONS (schematic).

and the influence of cold air cause the vein to collapse. Tying the cord shut permanently the supply of blood from the vein. Its walls agglutinate, and in a few weeks the vein is obliterated, remaining as a cord-like ligament for the ligamentum teres. The ductus venosus Arantii also collapses and disappears. As the pressure in the right auricle ceasing, that of the left auricle and ventricle increases, which results in the gradual closure of the foramen ovale. The foramen persists for months, or may be the cause of permanent and fatal cyanosis. Children with persistent patent foramen ovale are often cyanotic.



FIG. 84. DIAGRAM OF FETAL CIRCULATION—DIASTOLE.

especially when crying or on exertion, and are called "blue babies"—*morbus caeruleus*. The hypogastric arteries contract and thrombose, forming the obliterated hypogastrics of adult anatomy. This is due to the fact that the left ventricle, unassisted as formerly by the right ventricle via the ductus Botalli, cannot force the blood the long distance through the cord to the placenta. In addition, exposure to



FIG. 85. DIAGRAM OF FETAL CIRCULATION. NUTTALL.

cold contracts the umbilical arteries. The pulsation in the cord ceases, and the adult circulation is established. Normally, no clots form in any of the temporary fetal vessels except the hypogastric arteries.

**Special Physiology.**—The fetus in utero has all the functions of the infant, nutrition, digestion, assimilation, metabolism, heat-production and regulation, excretion, etc., but, owing to its particular environment, these are all much modified.

the placenta does several of the vital functions of the fetus almost entirely. It is the lungs of the child; it performs nearly all its digestion; it assimilates food; it stores up glycogen (Bernard), and it is the general excretory organ. The decidua seems to possess the glycogenic power—Zaretzsky. Its functions should be considered a little more in detail, though we will have to present much that is, at this time, unfinished or only partly proved.

*Respiration.*—Zweifel proved that the umbilical vein contains oxygenated blood, and the arteries venous blood. If the placenta becomes detached or the cord compressed, the child dies from asphyxia. These two facts prove that the fetal blood is supplied with oxygen in the placenta. The fetus needs little oxygen, as its combustion processes are slow; it moves little and meets with no resistance; it has no perspiration with evaporation from the skin. It loses no heat. Since this is so, the fetus tolerates withdrawal of its oxygen supply—asphyxia—very well for a time. As pregnancy goes on this toleration is lost. It is believed that the fetal blood is more and more venous in the later months of pregnancy. The process by which the fetal blood, carried to the placenta, becomes oxygenated is probably analogous to the process going on in the lungs. It is not by osmosis, because the oxygen is bound to the hemoglobin. The vital oxidizing power of the placental cells, perhaps through the medium of an enzyme, splits off the oxygen and carries it to the fetal red blood-corpuscles. The process is similar to internal or tissue respiration, and perhaps the fat in the villi facilitates the change (Hofbauer). Wolff has shown that in the Langhans cells granules exist which cause oxidative synthesis.

*Digestion.*—In many respects the villi of the placenta resemble the intestinal villi. In selective and vital action they exceed the latter in vigor and variety of function. The placenta is a large gland, and it probably assumes the functions which the adult glands later perform. The fetus needs albumin, fat, carbohydrates, water, and salts. Exactly how albumin is carried over from the mother's to the fetus' blood is not known. Albumose, but not peptone, is found in the placenta. Very probably the syncytial cells secrete an albumin-splitting enzyme, the protein going over into a compound of lower type, and the albumin is then re-formed inside the fetal vessels. Fat, according to Hofbauer, is found in the deeper parts of the syncytium and in the vacuolated cells in the form of fine droplets. It comes from the blood of the mother, and in small amounts from the glands of the uterus. In cows and dogs, for example, the connection of the villi with the glands is intimate, and the latter play an important part in fetal nutrition. Physiologists are not sure if fat exists in the blood, nor do they know how it passes over to the fetus. Unsulfated fat does not pass the placenta. Probably here again a fat-splitting enzyme (lipase) is in action, fatty acids and glycerin being formed. The analogy between intestinal and placental villi is again strengthened.

Glycogen, demonstrated by Claude Bernard in the placenta in 1859, exists also in the decidua and syncytium (Driessen). How this and other organic compounds reach the fetus is not known. But we do know, thanks to the researches of Bergell, Liepman and others, that many ferments exist in the placenta and probably the transfer is made in a way analogous to that of the intestinal digestion and absorption.

Water is readily absorbed by the villi, differences in the molecular concentration between the two bloods accomplishing the transfer. Of the metals, iron is one of the most important, and the fetus needs a great deal of it. There is no iron in the maternal plasma of the mother, therefore the red corpuscles must be used by the trophoblast to provide the necessary amount. Probably the syncytium has a cytotoxic or molytic action on the erythrocytes, perhaps dependent on the transformation of the lipid substances in the covering of the cells (Overton). The red blood-corpuscles are destroyed by the villi, and the hemoglobin, by complicated and not fully understood biochemical processes, is unmade and reformed in the fetal red blood-

corpuscles. Perhaps this destruction of erythrocytes accounts for some of anemia of women in the early months of pregnancy. Mayer, in 1827, proved that substances in solution in the maternal blood pass on to the fetus through the membrane separating fetal and maternal blood, *e. g.*, salts, potassium iodid, salic acid, atropin, etc., and in amount as they are dialyzable. We know that morphine, methylene-blue, the salts of mercury, lead, and arsenic pass over to the fetus. Gases pass over, as chloroform, ether, and carbon dioxid; therefore the danger of giving too much chloroform. Nicloux collected the literature on this subject up to 1909. Pregnant women should avoid large gatherings, or where large coal-stoves are used, as the carbon monoxid may injure the fetus.

The placenta, then, prepares the food for the infant, so that it may be immediately used for its general metabolism. In addition, the intact placenta offers a barrier to the passage of infection to the fetus. Only if its walls are injured will villi allow bacteria to pass. (See Pathology of Pregnancy.) If bacteria do pass, many toxins do, and antitoxins, *e. g.*, diphtheria and antitetanus serum, pass over (Wegelius), but the proof rests on weak foundation.

As another source of nourishment, mention must be made of the liquor amnii. It contains a slight amount of albumin, and the fetus drinks it in large quantities. This is proved by finding lanugo in the meconium, and the infant vomiting the liquor amnii after birth. The stomach of the fetus contains pepsin, and the intestine contains tryptic enzyme; therefore the function of digestion could be carried on. Water was probably supplied the fetus in this manner. Until the second month the fetus is almost all water, has less solids even than milk. At the end of pregnancy the fetus is 74 per cent. water. The liver is active, demonstrated by its preponderance in the meconium and the presence of bile in the meconium. The meconium is a tarry, greenish-black substance, found in the colon of the fetus in considerable quantity even at the seventh month. It accumulates in the colon and, therefore, peristalsis occurs in the intestines. This has also been demonstrated experimentally. The meconium becomes thicker in the latter weeks, since the intestine is absorbing. It is composed of secretions of the intestinal canal, the solid particles swallowed with the liquor amnii; lanugo, epithelium, vernix caseosa, and bile, and, chemically, cholesterin, bilirubin, fat, and mucin.

*The Kidneys.*—These are active from the early months, as Nagel has shown. Ahlfeld denies that the liquor amnii contains urine. He says the excretory matters which the kidney usually excretes are taken away through the placenta. Still, urea has been found in the liquor amnii; the bladder has been found distended even so as to be a hindrance to labor; the kidneys are there, and, by analogy with other organs, must work. Urine is often found in the bladder of new-born children. They sometimes urinate freely during delivery. Probably the action of the kidneys before birth is not constant nor considerable—rather, exceptional. Ahlfeld's arguments are very plausible.

The child has its own general metabolism—internal respiration, anabolic and catabolic, heat-production all go on as in the adult, but in varying degrees. Tissue changes are very active, since growth is so rapid, but the child needs to produce very little heat, being so well protected. Its temperature is one-half to three-fourths of a degree higher than that of the mother. The products of the metabolism are carried to the placenta. Glands with internal secretion probably functionate.

Less is known of the excretory functions of the placenta, but such a function surely exists, since the fetus has very little other outlet for its waste matters. Some waste may accumulate as meconium in the intestinal canal, and a little more may be passed as urine or perspiration. That the mother can absorb materials from the child is proved by the injection of a salt, as iodid of potassium, into the child, and its demonstration in the saliva of the mother. That substances will pass from the

re indicated below (Conn, Dawson, Morgan, Rauber, Lanms).  
may be determined—(1) In the ovum itself (progamy); (2) at the time of  
tion by the spermatozoid (syngamy); (3) by the influence of external factors  
the first formative period of the embryo (epigamy). All the theories pro-  
may be grouped under these headings.

romatic particles in the chromosomes of the germ cells are assumed to bear  
editary qualities. During the course of development these particles are  
ly distributed to the various cells in a definite way, as are the chromosomes,  
process of mitosis. At maturation, not only is the number of chromosomes  
(see p. 6), but it is assumed also that the number of hereditary qualities is  
l by half; in this manner a doubling of the number of hereditary qualities  
time of fertilization is prevented. The assumption that the chromosomes  
carriers of hereditary tendencies and determine sex is borne out by the ob-  
ons of cytologists on the germ cells of invertebrates, especially insects, and  
e vertebrates. According to Winiwarter after maturation all human ova  
24 chromosomes, while half of the spermatozoids contain 24 chromosomes,  
er half 23. There is thus one extra chromosome in each mature ovum and  
of half the spermatozoids. This chromosome, because of peculiarities of  
shape, can be identified easily in many animals, and is termed the *accessory*  
*ome*. McClung was the first to assume that the accessory chromosome is a  
erminant. It has since been shown by Wilson, Davis, and others that the  
y chromosome carries the female sexual characters. When, in the case  
onsideration, a spermatozoid with 24 chromosomes fertilizes an ovum, the  
g embryo is a female, its somatic nuclei containing 48 chromosomes. An  
ertilized by a sperm cell containing only 23 chromosomes (without the ac-  
chromosome) produces a male with somatic nuclei containing only 47  
omes.

butterflies, and perhaps in birds, the unpaired sex chromosome is found in  
m, but the mechanism of sex is identical. These cytological findings are  
supported by the extensive breeding experiments of recent years. Many of  
erly puzzling sex conditions have been analyzed and explained satisfactorily  
chromosome basis.

oeb, from a study of parthenogenetic frogs, concludes that all the ova  
s, but that the spermatozoids are of two kinds, with and without a sex

tempts have been made to influence nature, based on these, usually false, assumptions. Hippocrates and Galen believed that boys came from the right ovary, girls from the left, and Henke, in 1786, advised coition on the corresponding side when a child of that sex was desired. Hofacker and Sadler believed that the father, if older, would produce more males. Other statistics prove the reverse. The influence of "sex hormones" is being studied (Lillie).

Impregnation of an ovum before menstruation is said to produce females; afterward, males (Thury). Siegel utilized the unusual conditions of the great war to determine the time of conception and the incidence of sex. He found that if the husband returned on his short furlough right after the wife's menstrual period the majority of the children were boys; if in the ten days before the period, more girls resulted. One of his tables of 115 cases shows of 56 conceptions occurring from the first day of the period to the ninth day, 48 boys and 8 girls; from the tenth to the fourteenth day, 10 boys and 14 girls; from the fifteenth to the twenty-third day, 5 boys and 26 girls; from the twenty-fourth to the twenty-sixth, no conceptions; from the twenty-seventh to the onset of the next menses, 4 boys and no girls. Siegel concludes the overripe ovum (two days before to nine days after the beginning of the flow) shows 86 per cent. boys; the young ovum (from the fifteenth day after the onset of the menses to the twenty-third day) shows 84 per cent. girls.

Janke claimed the weaker party in the sexual act produced the opposite sex, and advised that either the man or the woman be at the height of sexual potency, depending on the sex desired. Düsing, from the study of 10,500,000 births, finds more boys are conceived in winter than in summer, and Ploss found that women in high altitudes give birth to more sons than those on the plains.

Schenk believed that the sex of the offspring depended on the nutrition of the mother; if her metabolism is so affected by conditions during pregnancy that sugar appears in the urine, the product of conception will be female; if the patient is kept on a diet that will prevent sugar, or reduce the carbohydrates in the urine, the child will be a boy. Experience has proved the utter fallacy of this theory.

Nature still holds the secret of sex production, and it is a question if it is desirable, even if it were possible, for man to interfere in the matter.

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## CHAPTER IV

### CHANGES DUE TO PREGNANCY

#### LOCAL CHANGES

rapidly growing ovum makes many demands on the maternal organism. It takes a great deal of room for its development, and a free blood-supply for its maintenance; then, too, the parturient canal must be prepared, and the means for the expulsion of the completed child. These are the local requirements; in addition, demands on the organs of general metabolism—the liver, lungs, the ductless glands, the nervous system, etc., and, unless the proper balance is maintained, either mother or child or both will suffer. To meet these demands of the growing fetus the whole body of the mother undergoes certain changes which for the purpose of study are divided into local and general.

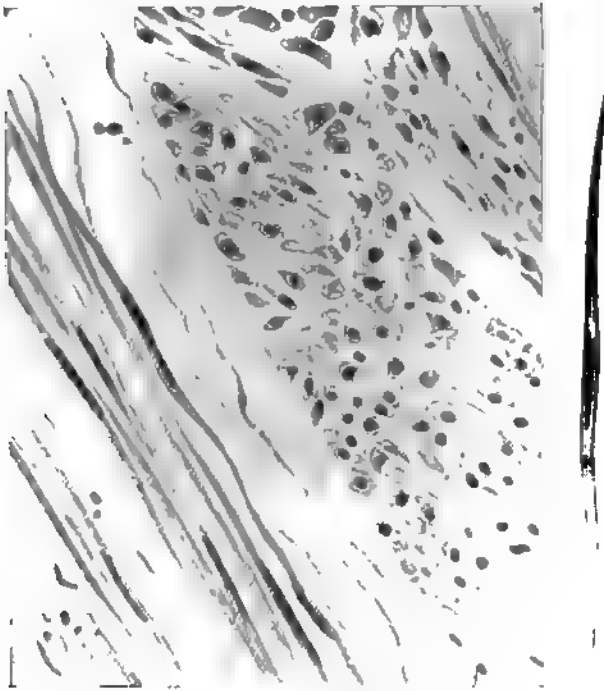


FIG. 86.—MUSCLE OF NON-PREGNANT UTERUS.

**Local Changes.**—Naturally the uterus is most markedly altered. The normal uterus of a nulligravida is a pear-shaped organ, 6½ cm. long, 2½ cm. thick, and weighing 42 gm. In multiparae the uterus is 7½ cm. long, 5 cm. wide, 3 cm. thick, weighing 65 gm. It is made up of hard, unstriped muscle, covered by the peritoneum, moored to the pelvis by eight so-called ligaments, and attached to the pelvic floor by means of the vagina.

During the first half of pregnancy the uterus enlarges as the result of a hypertrophy of its muscular substance. This is a true eccentric growth, is much more



rapid than is sufficient to accommodate the growing ovum, and is not due to expansion by the growing ovum, as the same changes occur in the uterus even when the ovum develops outside of it. There are hypertrophy and also hyperplasia of the cells. The wall of the uterus, which was 8 mm. before pregnancy, grows to be 25 mm. thick by the fourth month. After this the decidua reflexa comes to lie on and fuse with the decidua vera, and the development of the uterus is coequal with that of the ovum. At no time in pregnancy does the ovum actively distend the uterus.

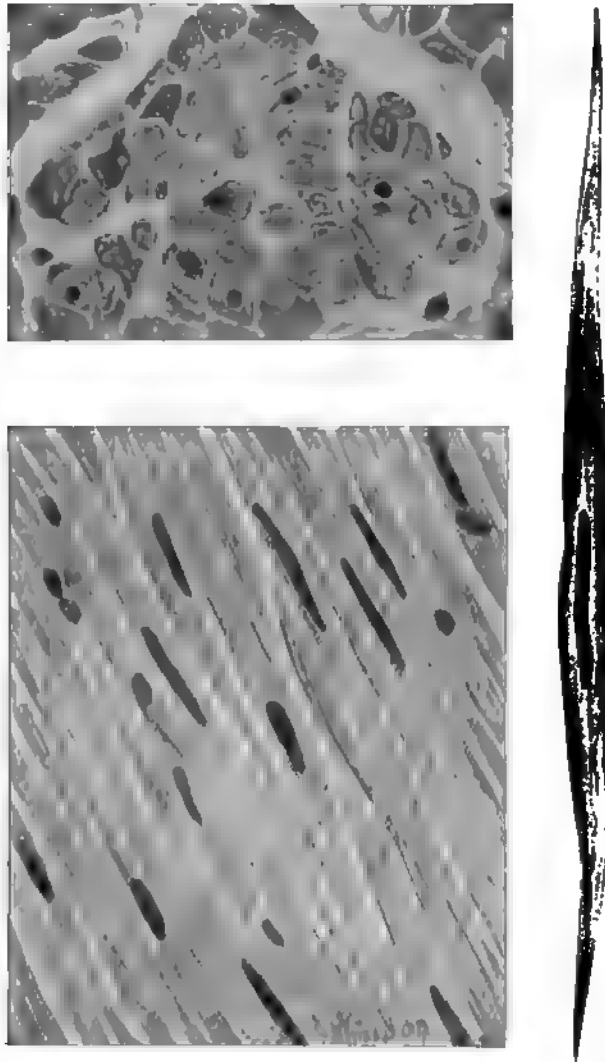


FIG. 87.—MUSCLE OF PREGNANT UTERUS. CROSS- AND LONG SECTIONS.  
Removed at time of a cesarean section.

In cases of twins and polyhydramnion there may be pathologic distention of the uterus. At the end of pregnancy the uterine wall varies from 4 to 7 mm. in thickness, and it is remarkable what muscular power this thin-walled organ may develop. The muscle-fiber of the non-pregnant uterus is spindle shaped, and about 50 $\mu$  long. That of the full-term pregnant uterus is enormously enlarged (200 to 600 $\mu$ )

resents fine longitudinal fibrillations (Figs. 84, 86, and 87). The muscle-fibers of the cervix also undergo hypertrophy, but not as much as those of the fundus.

cross-striated muscle-fibers have been found in the uterus, a phenomenon which may indicate metaplasia.

The fibro-elastic tissue of the uterus is of great importance in view of the functions of the organ and its resistance to distention and the stress of labor. Jensen and others have shown that the fundus is less rich in elastic tissue than the cervix, that the fibers are most numerous in the outer layers of the uterus and that the vessels, from which they probably arise. Fieux states that the muscula-

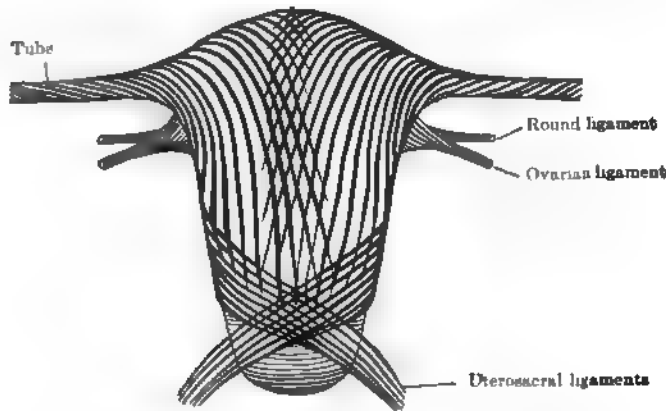


FIG. 88.—SCHEMA OF THE OUTER LAYER OF UTERINE MUSCLE-FIBERS.

of the cervix has disappeared before term, to be regenerated after labor, so that at the end of pregnancy the cervix is composed entirely of connective tissue. Jensen has confirmed this view.

The uterine connective tissue becomes augmented, softer, and slightly fibrillar, permitting free motion between the muscle-bundles and layers. How much metaplasia exists is under question.

The arrangement of the muscle-fibers has been the object of an immense amount

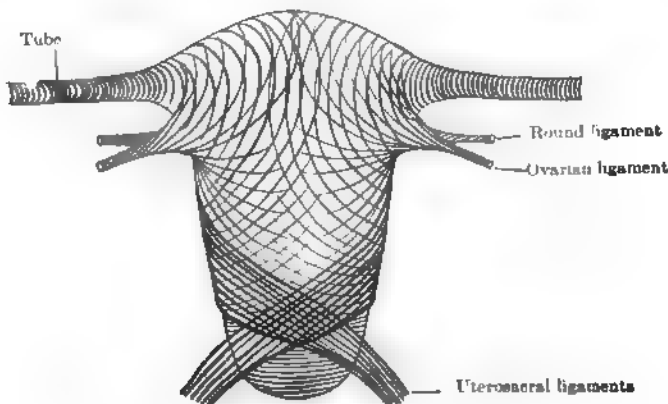


FIG. 89.—SCHEMA OF THE INNER LAYER OF UTERINE FIBERS.

ly, and it is not yet fully understood. Bayer gives a full history of the subject, and his description, with those of Helie and Chenantais, will be followed. The uterine wall may be distinguished: an outer thin, an inner, also thin, and a middle layer.

the middle, very thick and vascular. These layers are distinguishable only in pregnancy. At cesarean sections one observes them, and it is possible to separate them individually by suture. Since the uterus is the result of the fusion of the Mullerian ducts, we would expect the tubes to play a rôle in the distribution

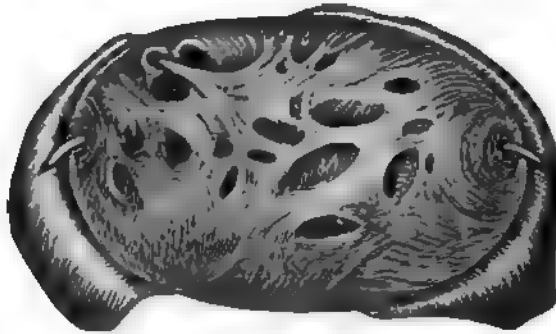


FIG. 102. -DISSECTION OF UTERINE MUSCLE. FUNDUS (from Hele and Chenantais).

uterine muscular fibers, and this is borne out by various dissections. The uterine ligaments also determine the direction of the muscular bundles (Ivanoff).

The outer layer of the uterus covers the fundus down to the point where



FIG. 103. -DISSECTION OF UTERINE MUSCLE. LONGITUDINAL SECTION (from Hele and Chenantais).

perimetrium is derived essentially from the outer mass of the longitudinal fibers (Ivanoff, Fig. 103). The latter are continuous with the sides of the uterus.

and-vessels enter. The fibers are more or less longitudinal, and interlace in the middle, some crossing to the opposite side. The inner layer of the longitudinal muscle of the tube is continued under the endometrium, and forms the looped bundles of muscle around the tubal ostia and around the internal os. It also shows a banding on both the anterior and posterior wall of the uterus and fibers run from the fundus to connect the two. Around the tubal ostia and the internal os there are also irregularly circular thickenings. The internal layer is more closely applied to the middle portion than is the outer layer. The powerful middle layer is composed of the circular fibers of the tube and the radiating fibers from the uterine ligaments, the round and the ovarian ligaments (Fig. 89). These layers, during the development of the uterus in pregnancy, exert a marked influence in the direction of its growth, and during labor have a decided influence in

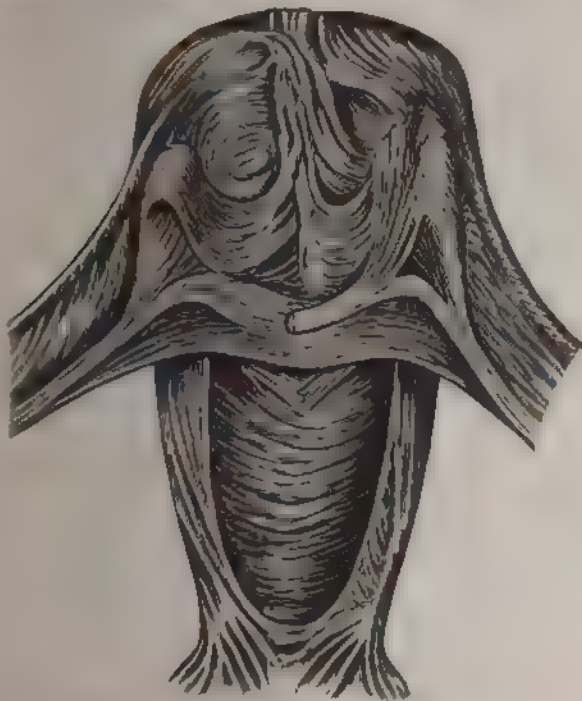


FIG. 92. MIDDLE LAYER OF UTERINE FIBERS (from Hebe and Cherepntais).

mechanism of the process. Many fibers run obliquely through the wall of the uterus, binding all the layers firmly together, and they enable the uterine wall to be firmly felted together under the influence of the contractions.

As a result of the crossing and recrossing of the various muscular lamellæ and bundles, a most complicated network results, and through this network the vessels of the uterus pursue their course. It is easily seen that when the uterus contracts, these vessels will be twisted, bent, and closed. This is what occurs in the third stage of labor after the child is expelled. The lamellar structure of the uterus is necessary to permit the distention of the uterus and its adaptation to the growing ovum.

The muscle-fibers of the cervix pursue simpler courses. At the isthmus the layers are prominent, especially at the insertion of the retractor fibers in the cervix, i. e., the uterosacral ligaments. The plicæ palmatæ are made up of longi-

smallest branches, and their anastomoses are frequent and full (Fig. 93). (See also Redlich for literature.)

The veins are much more developed than the arteries (Fig. 93a), and in general follow their course. They penetrate all the layers of the uterus, especially the middle, anastomose very freely, and empty into the plexuses at the sides of the uterus in the ovarian and broad ligaments. The former empties into the renal vein or the ilia, the latter into the hypogastric vein, and thence into the internal iliac. The uterine veins have no valves.



FIG. 93a. UTERINE VEINS. RIGHT ANTERIOR SURFACE OF UTERUS, SEVENTH MONTH (adapted from A. Couvelaire).  
LR, Round ligament.

Microscopically, both arteries and veins, particularly the veins, undergo interesting changes in the uterine wall. They lose their outer coats, and come to rest on the muscle-bundles, with only an intima or with very little tunica media, thus forming large blood-spaces called sinuses. The uterus thus seems to form part of the vascular system, and, as a matter of fact, it follows vasomotor impulses, for instance, the action of ergot and pituitrin and of nervous shocks.

The lymphatics of the uterus enlarge and multiply during pregnancy, so that the full-term organ is well honeycombed by them. They begin as large spaces under the endometrium and under the serosa, following the course of the muscle-bundles and blood-vessels; they anastomose freely under the serosa, communicating by stomata with the peritoneal cavity, and empty into the vessels of the broad

connection between the uterus and the stomach and heart may explain the reflex phenomena intercurrent between these organs. Sensory fibers come from the spinal cord through the sacral nerves, being also distributed via the great cervical

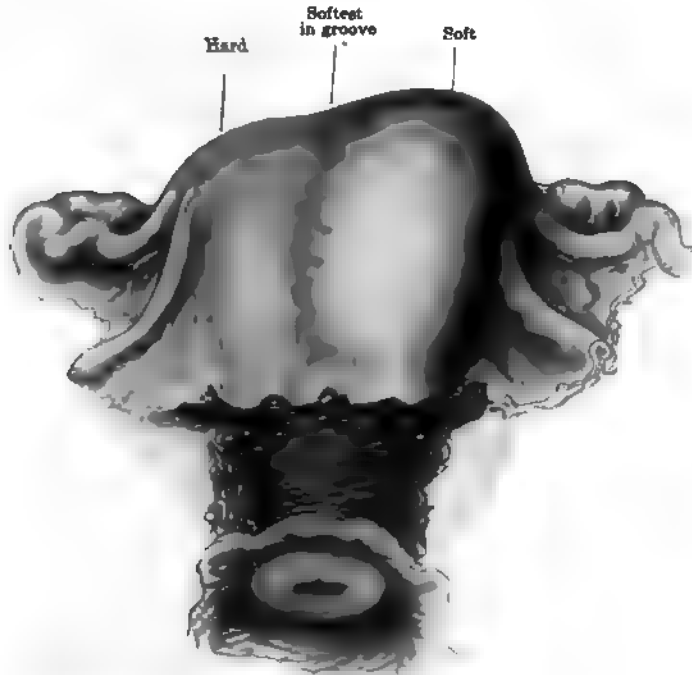


FIG. 95.—UTERUS AT EIGHT WEEKS.  
Note enlargement of one half.



FIG. 96.—UTERUS AT FIVE WEEKS.  
From Professor Jaggard's collection.

Ovum covered by reflexa  
External os

union. That the sensory fibers come from the spinal cord in this way is shown by the clinical observation of painless labors in paraplegic women, and rendering

the labor painless by the injection of stovain into the spinal canal. The region supplied by the cauda is made anesthetic. The great cervical ganglion (Frankenhäuser) is a triangular mass of ganglion-cells and nerve-fibers lying at the side of the cervix and upper vagina,  $\frac{1}{2}$  inch wide and  $\frac{3}{4}$  inch long. During pregnancy it grows to be 2 inches long and  $1\frac{1}{2}$  inches wide. Another ganglion exists on the posterior wall of the cervix.

The nerve-centers are less well known. One is believed to exist in the cortex, one in the medulla, in the cerebellum, and in the lumbar enlargement of the cord, because irritation at these points causes uterine contractions. There is an independent nerve-center in the uterus, because the organ acts even when removed from the body. Cases of paraplegia are on record where labor was normal or even pre-

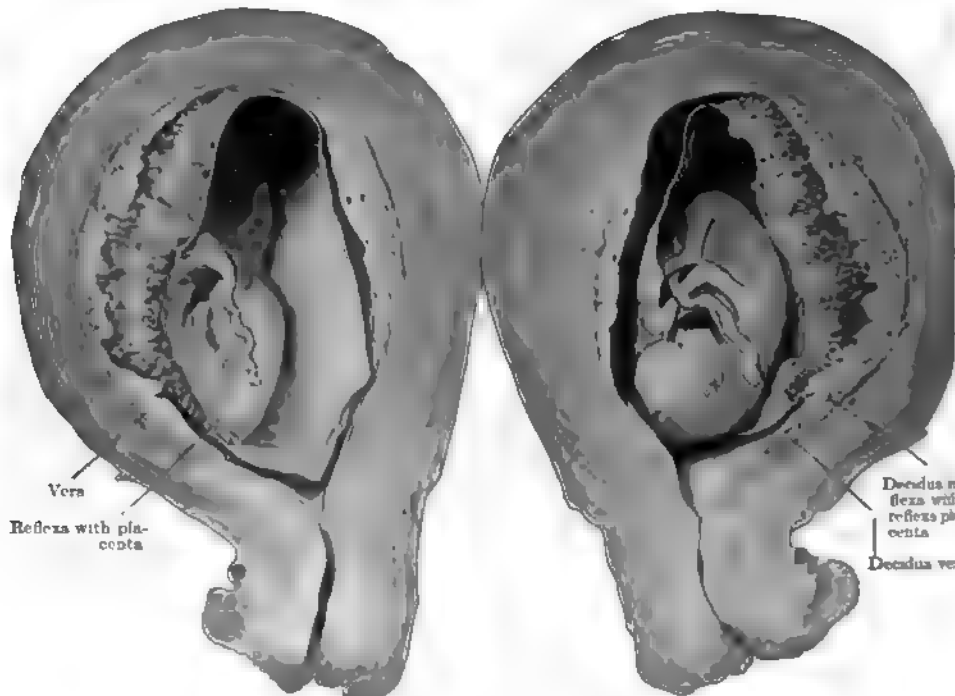


FIG. 97.—UTERUS AT TWELVE WEEKS.  
Northwestern University Medical School Museum.

cipitate. The author delivered a paraplegic with forceps after the head was visible because of failure of the abdominal muscles to contract. This local center is supposed to be the great cervical ganglion, but there exist ganglionic cells in the uterine muscle, and they form occasional small plexuses around the blood-vessels (Bar).

**Changes in the Shape of the Uterus.**—Within two weeks after conception the shape of the uterus begins to change. This is first appreciable in the anterior-posterior diameter of the corpus. The ovum softens and distends that part of the uterus in which it is situated. As this is usually the anterior wall, we find a bulge here on one or the other side of the median line, making the affected side larger, thicker, and softer, while the other is smaller, thinner, and harder, there being a groove between (Fig. 95). These findings are useful in the diagnosis of pregnancy. The cervix softens, especially the supravaginal portion, its acquired compressibility giving Hegar's sign of pregnancy. The junction of the tubes with the uterus also softens. These conditions are brought about especially by imbibition of the uterine

and the movability of the outer lamella of the uterine muscle on the middle. After the second month one finds the uterus enlarged laterally, and in the fourth month the fundus has assumed nearly a spheric form. The consistence of the uterus at this time is spongy, elastic, and soft, like bread dough, and one often finds the organ harden under the examining hand—that is, it contracts. The cervix softens and enlarges up to the fourth month, when it resembles a lip hanging from the globular corpus. Normally, the mucous membrane of the cervix is not altered into decidua, and it produces a thick, tenacious mucus, which fills the canal, closing the uterine cavity from the vagina. This mucus is constantly renewed from above and prevents ascending infection. After the sixth month the uterus enlarges in the direction of the fundus, the spheric form



FIG. 98.—UTERUS ABOUT SIX MONTHS.  
Author's collection.

becomes more ovoid or elliptic. The location of the tubal insertion and of the round ligament shows this change, at the fifth month being near the vault of the uterus, in the ninth month being 4 to 6 inches lower. During the last weeks of pregnancy the lower part of the uterus is developed to accommodate one pole of the infant, the so-called lower uterine segment being formed. This completes the ovoid or pear-shaped formation of the uterus (Figs. 98, 99, 100, 101, 102).

The virgin uterus is shaped like a flattened pear, and has a capacity of 2 c.c.

The full-term uterus resembles an immense gourd, and has a capacity of about 5000 c.c.

The configuration of the uterus is affected by the organs in the belly, the position and attitude of the fetus, the amount of liquor amnii, the location of the placenta, the attitude of the mother, uterine neoplasms, adhesions, etc. The spinal



column presses into the uterus from behind; the intestines leave facets on its walls. Since the anterior wall is supported solely by the abdominal muscles, it bulges forward convexly. The fetus kicks out the non-resistant muscle, as may be observed during any abdominal examination. In shoulder presentation the uterine ovoid is transverse. A large quantity of liquor amnii makes the uterus spheric and tense. The placenta develops that part of the uterus to which it is attached, and, from the location and course of the round ligaments, we make deductions as to the seat of the placenta (Palm). If the round ligaments run on the anterior surface of the uterus, the placenta is located on the posterior wall; if they are far to the side, the placenta is located anteriorly (Figs. 102 and 103).

We find, at term, uteri of various shapes—ovoid and elliptic, cordate and asymmetric (Figs. 104, 105, 106, 107, 108). Occasionally the fundus presents a shallow groove (Fig. 106), the uterus having an indication of horns—uterus arcuatus.



FIG. 99. —UTERUS NEAR TERM.  
From Professor Jaggard's collection. Note primary brow presentation.

Sometimes one horn is developed more than the other (Fig. 107). The uterus at term, in 80 per cent. of cases, is deviated to the right side of the abdomen, and it is also twisted on itself from left to right. This dextroversion and torsion, which are also found in the virgin state, are due to the mode of formation of the uterus from the Müllerian ducts—in the embryo the left duct lies anterior to the right; second, the location of the mesenteric attachment of the sigmoid on the left side of the spinal column; third, congenital asymmetry of growth, which is noticeable even in vegetable life—for instance, trees and shrubs; fourth, the full rectum; fifth, the general habit of lying on the right side—the uterus falling over from the left. This dextroversion of the uterus is of considerable clinical importance. In abdominal examinations the left tube and ovary may be felt nearer the middle line, and the round ligament also is more prominent on the left side. During the operation of cesarean section it is necessary to bring the uterus to the middle line before making the incision for the delivery of the child.

For the first three months of pregnancy the uterus is entirely a pelvic organ. As it becomes anteverted and anteflexed and lies on the bladder. The fundus

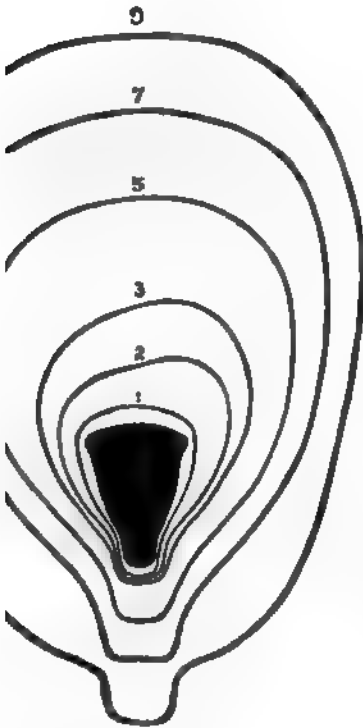


FIG. 100.—UTERUS AT SUCCESSIVE MONTHS.



FIG. 101.—SAME FROM SIDE.



FIG. 102.—COURSE OF ROUND LIGAMENTS WHEN PLACENTA LIES ON POSTERIOR WALL.

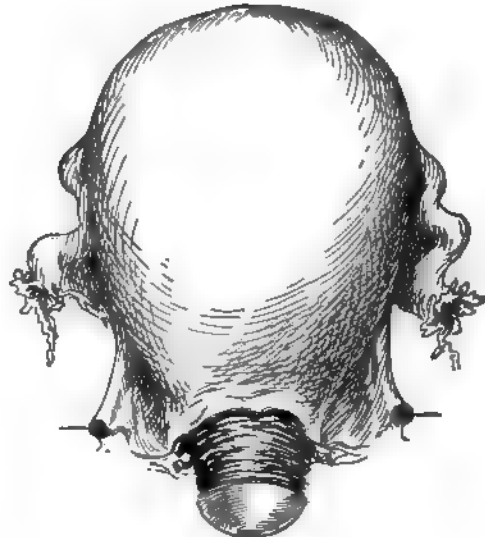


FIG. 103.—SAME ON ANTERIOR WALL.

The sign is usually but not invariably reliable.

ily felt through the anterior fornix. The cervix is directed forward (Fig. 110). pregnancy develops the uterus rises up in the abdomen, coming to lie against erior wall. In primiparae the uterus is molded against the spinal column more

than in multiparæ, because in the latter the abdominal muscles are usually not so strong and rigid. The intestines are forced upward and usually to the left. No intestine is normally found between the uterus and the abdominal wall. A hernia is sometimes emptied of gut during pregnancy. The colon retains its position.



FIG. 104.—OVOID UTERUS.



FIG. 105.—ELLIPTIC UTERUS.

The fundus uteri at term is about the level of the second lumbar vertebra. It exerts no direct pressure on the kidneys, liver, or stomach, and is, therefore, not answerable for certain troubles of these organs ascribed to it, as nephritis, icterus, intercostal neuralgia, hyperemesis. In the latter three months the lower pole of the uterus lies on the ureters as they cross the brim of the pelvis. Undoubtedly,

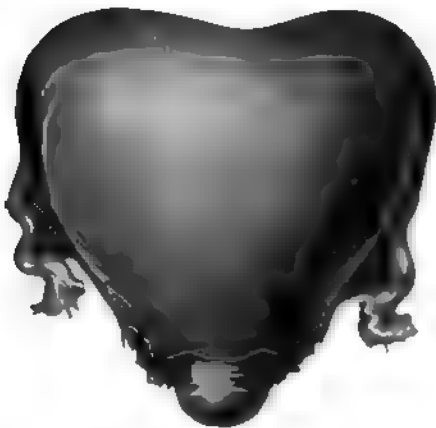


FIG. 106.—UTERUS ARCTATE.



FIG. 107.—ASYMMETRIC DEVELOPMENT.

the ureters are sometimes occluded by the growing uterus, but it is not by its weight, because the specific gravity of the organ is the same as that of the intestinal mass. Probably the ureters are bent or twisted during the changing of the relations of the pelvic viscera.

The bladder during early pregnancy is a pelvic organ. In the last month,

*pari passu* with the development of the lower uterine segment, the bladder is drawn up from behind the pubis into the abdomen, generally to the right. During labor the uterus draws away from the bladder, but the latter, when filled, may reach above the navel. The urethra is stretched only when the bladder is overfilled, or during labor when it is out of the true pelvis. Often the bladder is saddle shaped, extending on each side of the pelvis. It may also be asymmetric, and then the larger part is oftenest on the right.

The axis of the uterus varies in its relation to that of the axis of the pelvic inlet. In *primiparæ*, standing, the two axes sometimes correspond (Fig. 111). In *multiparæ* the lax abdominal wall allows the uterus to fall forward. If the recti abdominis are widely separated, the fundus falls between them, resulting in "pendulous abdomen," or "rupture," as the women term it (Fig. 113). When the woman

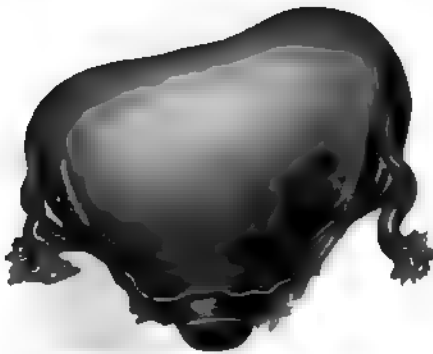


FIG. 108.—UTERUS WITH TRANSVERSE PRESENTATION OF FETUS.



FIG. 109.—OVOID UTERUS FROM SIDE. Shows flexion over spinal column.

lies in the horizontal position, the uterine axis sinks behind that of the inlet (Fig. 112).

Up to the seventh month the growth of the uterus is fairly uniform, and we may draw qualified conclusions as to the duration of pregnancy from the height of the fundus above the pubis. If the fundus reaches one-third the way to the navel, the pregnancy is of four months; if two-thirds, five months; at the navel, six months; one-third the distance to the ensiform, seven months; two-thirds, eight months; at the ensiform, nine months. Now the uterus sinks down and forward, the process being called "lightening," and reaches the level it had at the eighth month. Naturally, the accuracy of these decisions is not great, being disturbed by the inconstancy of the location of the navel, the elasticity of the belly-wall, and so many intra-abdominal conditions, the amount of liquor amnii, the size of the child, its position, etc. Toward the end of the last trimester the shape of the uterus alters. It becomes longer, which is due to the head passing into the newly formed lower uterine segment, a change less observable in *pluriparæ* until actual labor begins. The formation of the lower uterine segment is caused by several

factors, and may be part of the process of lightening—the weight of the child, intermittent uterine contractions, the action of the round ligaments, the tightness of the abdominal wall, and this is the reason that lightening is more likely to be found in primiparæ.

The uterus, owing to absorption of some of the liquor amnii, conforms a little more to the shape of the child and flattens at the fundus.



FIG. 110.—UTERUS AT END OF THIRD MONTH.  
Shows long cervix, sharp anteversion, and how the fundus rests heavily on bladder.

**Lightening.** Two to three weeks before labor the uterus sinks down and forward. The women call this "settling" or "dropping"; the technical term is "lightening." It is due to the gradual sinking of the child's head into the pelvis, and occurs only in primiparæ with normal pelves, or multiparæ with no pelvic and well-preserved abdominal muscles. Lightening may be simulated by the sudden weakening of the abdominal wall, which sometimes occurs late in

y, and by the absorption of the liquor amnii. Both of these conditions produce changes in the contour of the belly, relieve the distress in breathing, and show symptoms attendant on true lightening. The differential diagnosis is easily

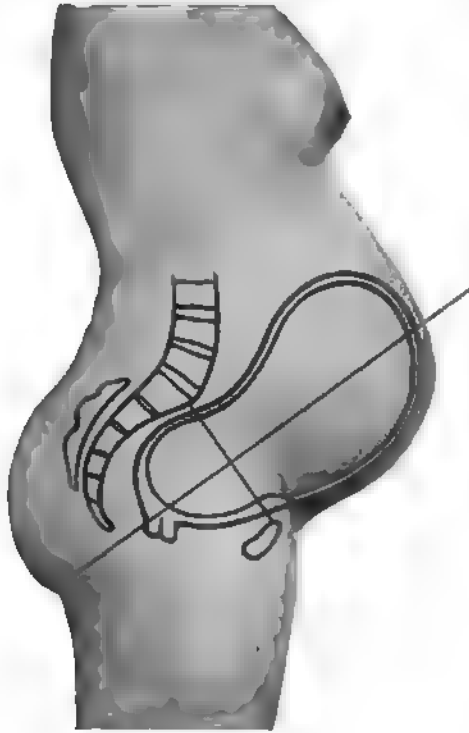


FIG. 111.—SHOWS RELATION OF UTERINE AXIS TO AXIS OF INLET IN THE ERECT POSTURE (PRIMIPARA).

by finding that the head has not engaged and that the changes in the cervix that to be described have not taken place. When the uterus sinks, the intestines and stomach have more room, the epigastrium is free, the diaphragm regains more

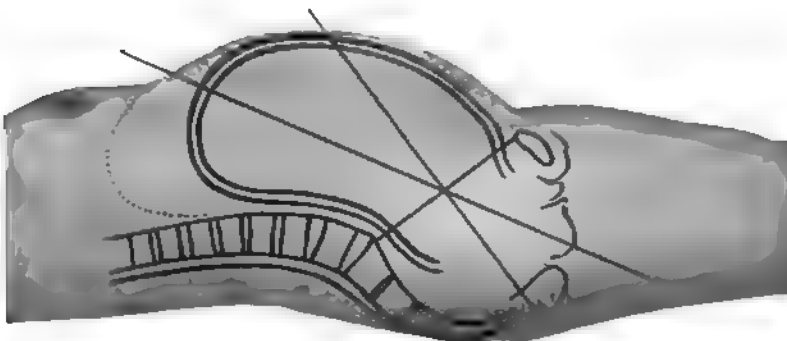


FIG. 112.—SAME PRIMIPARA, LYING FLAT.  
Shows crossing of axes.

by its usual level, the waist-line sinks so that the woman can fit her skirts better. On the other hand, the head presses upon the bladder and rectum, producing symptoms from these organs; walking is rendered more difficult, and many pains of a gynecologic nature and much distress referred to the pelvis are complained of.

On internal examination one finds the vault of the pelvis filled by the head, and the cervix, which before was a prominent protuberance on the lower uterine segment (Fig. 116), now has been flattened out against the head so that it can hardly be recognized as apart from the vagina. Often too the vagina is folded on itself like a loose cuff, and this might be mistaken for the dilated os or a stricture (Fig. 118).

Sometimes lightening occurs suddenly, attended by more or less regular labor-pains. The patient summons the physician, but labor does not occur, and sometimes does not come on for two weeks. These cases are not to be confounded with protracted gestation and postponed labor (*q. v.*). Lightening may occur as early as the seventh month, and the head may recede and enter again, or later be prevented from engaging by having overgrown the size of the inlet in the meantime. As a rule, however, the phenomenon indicates that that head is not too large to go through that particular pelvis, and, therefore, is always a welcome sign. If the head remains very low in the pelvis for several weeks, it may be molded to the pelvic floor, and be flattened on the posterior parietal bone, a deformity more or less permanent.

#### The Cervix and Lower Uterine Segment.—

FIG. 113.—MULTIPARA STANDING. PENDULOUS ABDOMEN.

The unimpregnated uterus has two parts—the corpus, or body, and the cervix. Some authors distinguish a third portion—an “isthmus,” at the junction of the two, and many points are in favor of the view that such a zone exists. The cervix is about as long as



FIG. 114.—SILHOUETTE OF A PRIMIPARA BEFORE LIGHTENING.



FIG. 115.—SAME AFTER LIGHTENING.

the body, and the insertion of the vagina makes three more or less sharp divisions (Fig. 19). The anterior wall of the vagina is inserted 1 to  $1\frac{1}{2}$  cm. from the external os; the posterior wall about 3 cm. above the external os; and the cervix extends about 1 cm. above the latter point. That portion of the cervix lying entirely in the vagina is called the vaginal portion—sometimes simply “portio”; that which lies behind in the vagina and in front against the bladder, the median portion; and that which lies above the vaginal insertion, the supravaginal portion. If one examines the cervix of a pregnant woman at successive weeks, marked changes in consistence, form, and position will be noticed. Within a few weeks after conception the tip of the cervix begins

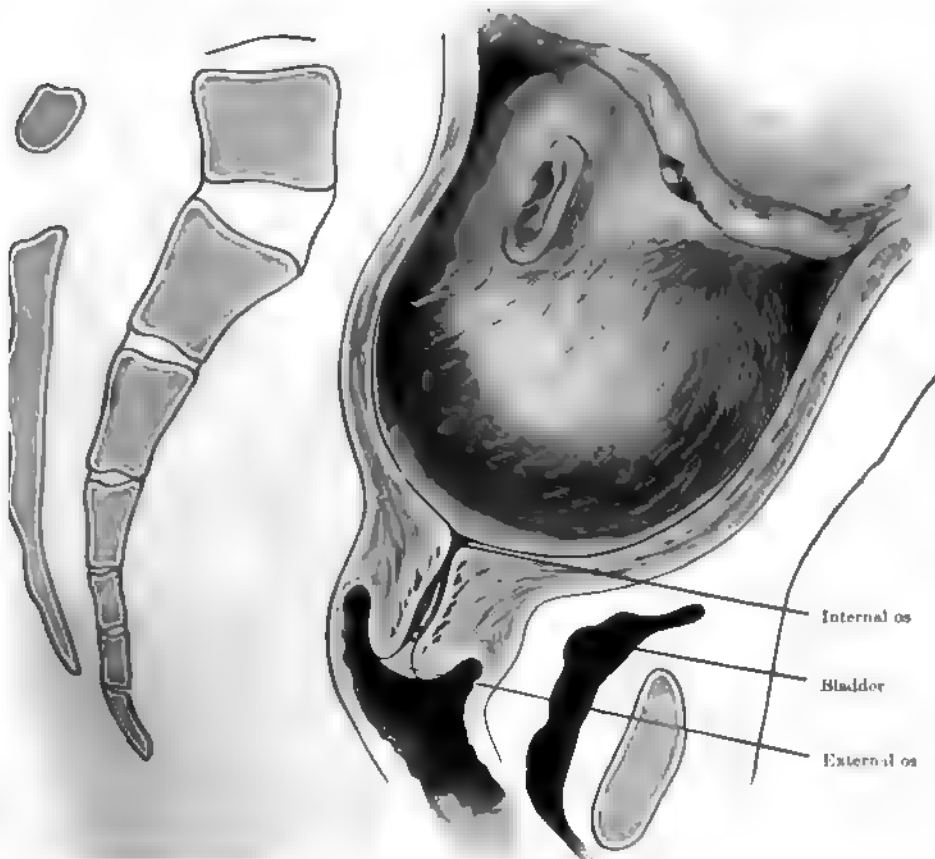


FIG. 116.—HEAD AND CERVIX BEFORE ENGAGEMENT.

to soften, and this increases upward toward the corpus and from without inward. The softening is caused by imbibition of the tissues and increased vascularity, both arterial and lymphatic. The ante flexion of the uterus being increased, the cervix points forward, and the uterus, as a whole, sinks lower in the pelvis. This is especially noticeable if the woman wears tight corsets. The cervical canal in the first 3 months runs from below and forward, behind and upward (Fig. 110). When the uterus rises up into the abdomen, the cervical canal takes a more vertical direction, the angle of the point of ante flexion becoming obtuse. The softening now pervades the whole cervix and paracervical tissues. The canal is closed by a tough mucous plug, which hinders the ascent of infection. In multiparæ as



early as the fifth month the external os is often patulous, and will admit the finger one-half inch. This is especially true if the cervix has been lacerated and not repaired.

In the seventh month the succulence which affected the cervix has pervaded the whole pelvis, and the outlines of the former are hard to distinguish. The cervix has taken a position higher and further back in the pelvic cavity. The external os always admits the finger in multiparæ, and occasionally in primiparæ. The cervical canal is directed backward, but exceptions are not uncommon. The author

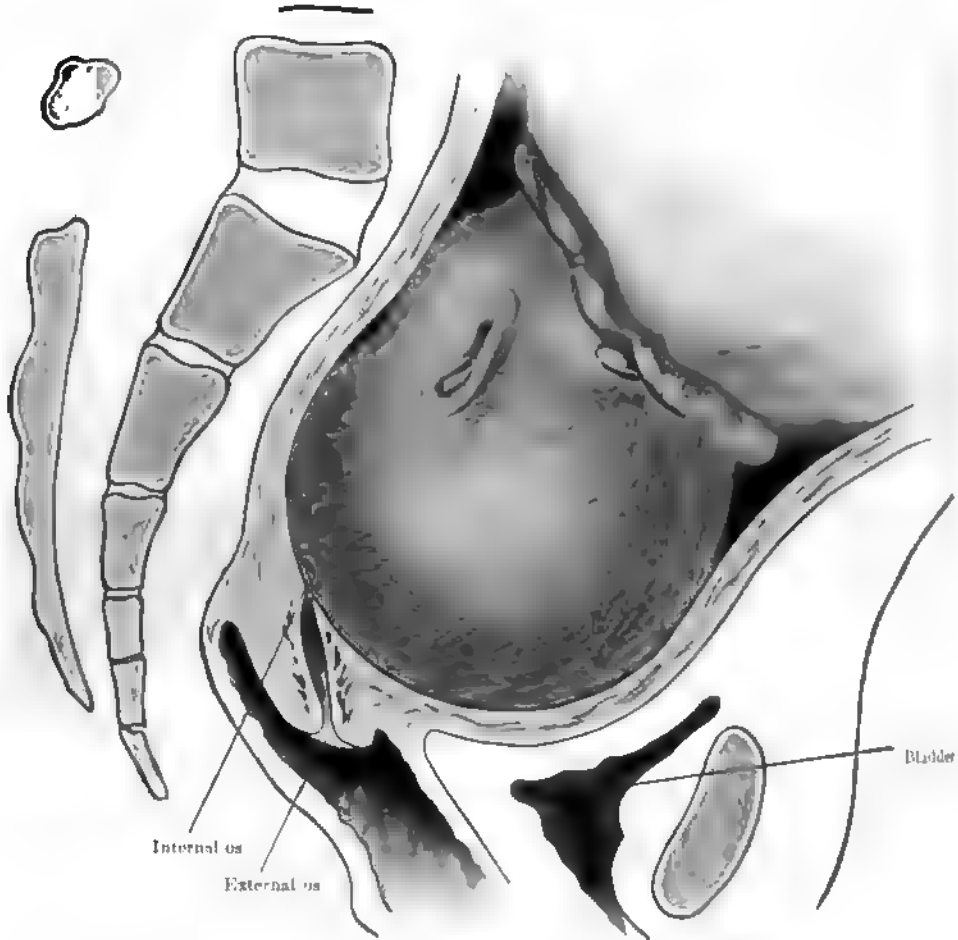
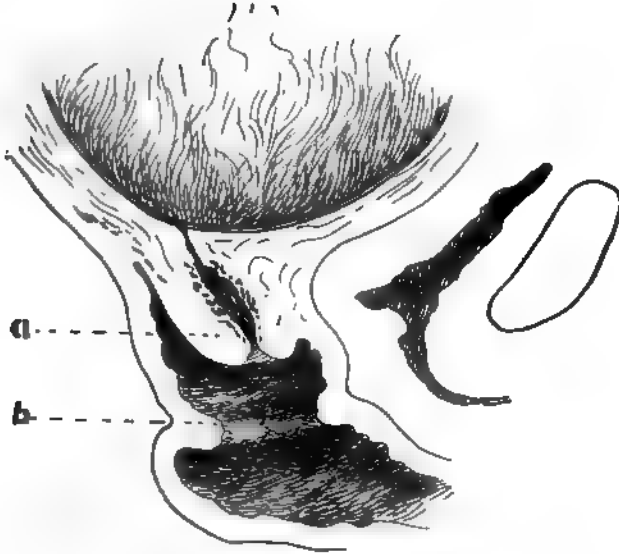


FIG. 117. —EFFECT ON CERVIX OF ENGAGEMENT OF HEAD.  
Sometimes the canal is directed backward.

has found it sometimes points forward and upward. The internal os is usually closed both in primiparæ and in multiparæ, though it occasionally admits the tip of the finger in the latter. The cervix begins now to flatten out against the fetal head, seemingly to be taken up and used as part of the uterine cavity. This is the impression one receives from the examining finger, but frozen sections prove that it is not always the case.

In the ninth month the softening and succulence of the cervix and neighboring tissues are greatest, since the venous congestion is at its height and the uterine contractions of pregnancy force a great deal of serum into the tissues. Sometimes

the educated finger experiences difficulty in outlining the structures. The irritation of the epithelium often leads to erosions, and catarrhal affections of the



19.—FOLDING OF THE VAGINA (b) DURING THE PROCESS OF LIGHTENING, SIMULATING THE EXTERNAL OS (a).

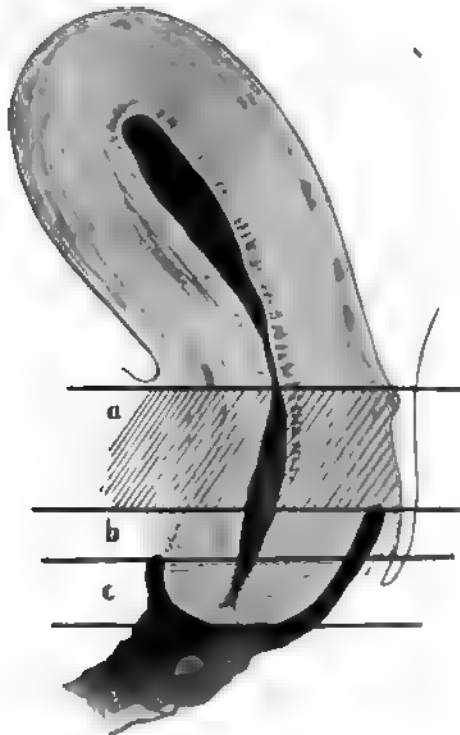


FIG. 112.—THE THREE CLINICAL DIVISIONS OF THE CERVIX.  
a, vaginal portion; b, median portion; c, vaginal portion. The "isthmus" would be right above the line at a.

c are much aggravated. Hence the gravidæ frequently have leukorrhea. If patient previously had cervicitis with erosions, the condition may become

so marked as to require treatment, because of hemorrhage, profuse and irritating discharge, etc. The changes in the direction of the cervical canal have been

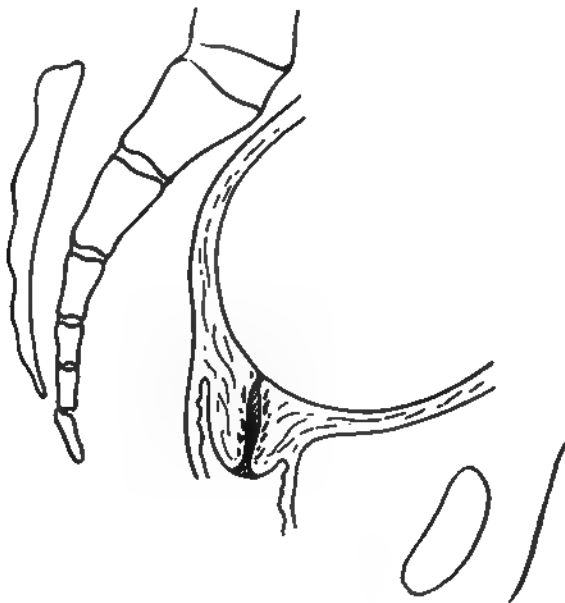


FIG. 120.—CERVIX AS MOST COMMONLY LOCATED.

described under the heading of Lightening (p. 86). The external os, even in primiparæ, now usually admits the index-finger, and in most of the cases the internal os will also allow the finger to pass. This is especially true of multiparæ in whom two

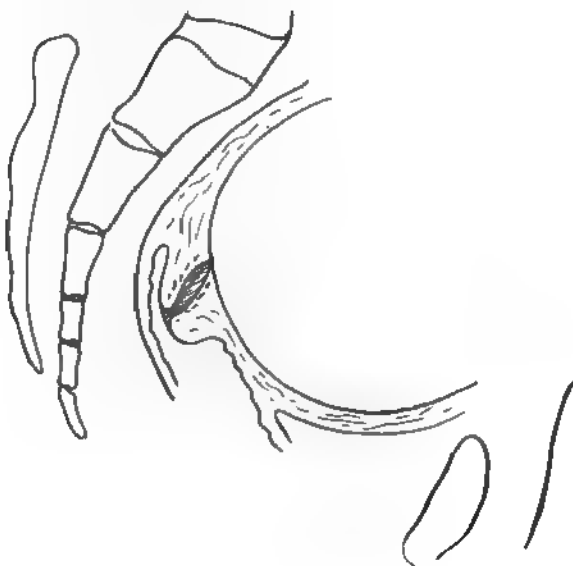


FIG. 121.—CERVIX IN HOLLOW OF SACRUM.

or even three fingers may be inserted. The shape and size of the external os are much affected by previous laceration or scar formation. One will find many individual differences. The author has found the cervical canal in an old primipara

d at the thirty-third week so that the external os admitted the middle and the internal os was the size of a nickel. While the extreme softening and enlargement of the cervical canal indicate that labor is near, still, in view of as been said, absolute reliance may not be placed on these signs. In the week or ten days the uterine contractions often bring about a true effacement of the cervix, and use it to form the lower portion of the uterine cavity, thus anticipating the first stage of labor. This is called "insensible labor" by the physician, and is a welcome finding to the obstetrician, as it facilitates all operative measures should hasty delivery be necessary. A cervix that remains long and closed up until labor begins is not normal.

The location of the cervix at full term varies. Rarely one finds it anteriorly on one side; most often it is in the middle of the pelvis (Fig. 120), and many times it is back in the hollow of the sacrum (Fig. 121). If it is high up near the sacrum and hard to reach with the finger, the condition is pathologic. In cases of

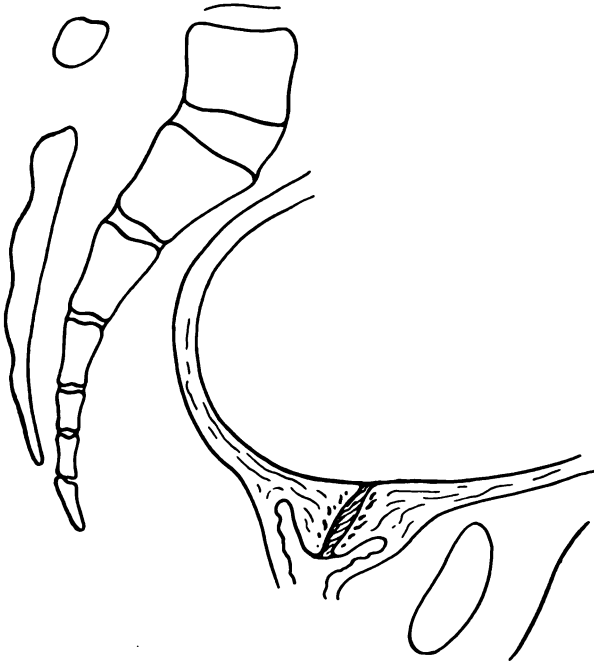


FIG. 122.—CERVIX NEAR PUBIS.

inverted uteri, the cervix may be located above the promontory in the abdominal

The relation of the cervix to the lower uterine segment has been the subject of conflicting theories since 1746. Mauriceau and Levret taught that from the seventh month the upper portion of the cervix was unfolded or effaced, drawn up, and formed part of the uterine cavity, until at term only a small part of the cervix remained. Stoltz, in 1826, denied this, claiming that the cervix remained closed until near the advent of labor. Both opinions were based on the results of vaginal examination. Bandl, in 1876, as the result of examination of many uteri, reaffirmed the latter theory, while Schröder, Ruge, Leopold, and very many others have sought to prove that the cervix does not, during pregnancy, form part of the uterine cavity. Bandl has done the most work on the subject, and his conclusions are slowly gaining more and more acceptance. They are supported by the latest and best frozen sections by Bumm and Blumreich. If one examines a gravida in the last month of pregnancy, one will often find conditions as indicated in Fig. 123. The finger

passes along the cervical canal, meets a ring at Os I, generally termed the internal os, and, if this point does not offer resistance, enters the cavity of the uterus, finds the membranes but lightly adherent to the lower pole of the same, and about an inch from the internal os, at the level of the pelvic inlet, encounters a slight ridge, C.R., above which the hard, muscular uterus is felt. The portion from Os I to C.R. has been called the lower uterine segment, and its origin has been much discussed—its existence even been questioned. The old theory, supported by Mauriceau, Bandl, Bayer, *et al.*, was that the lower uterine segment was the expanded upper portion of the cervix. The newer theory, supported by Stoltz, Schröder, Hofmeier, *et al.*, was that the lower uterine segment came from the uterus itself, its lower portion being thus differentiated. Both theories have this in common, that there is such a zone as the lower uterine segment, and that it is different in structure and formation from the fundus uteri. Braune and Bumm claim that it is formed during labor, the cervix and uterus remaining unchanged until pains begin.

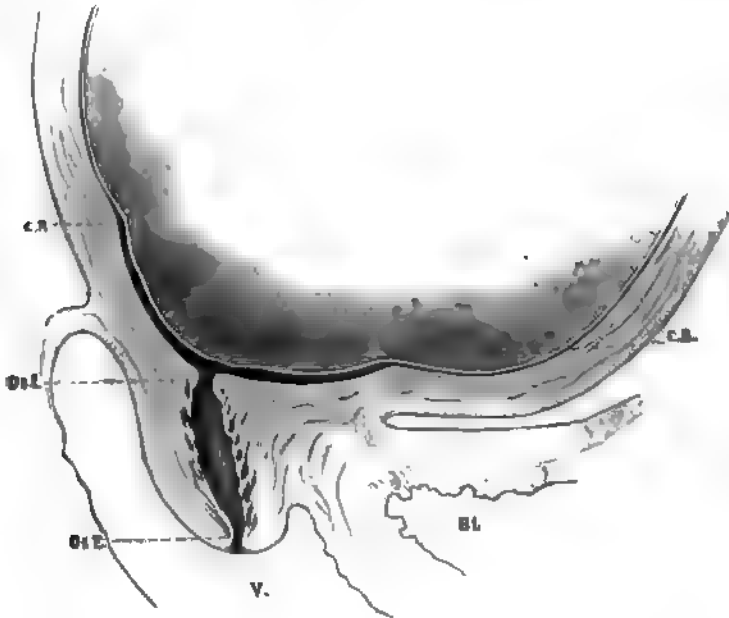


FIG. 123. —THE CERVIX AND LOWER UTERINE SEGMENT AT THE END OF PREGNANCY.  
Os E, Os externum, Os I, os internum, C.R., contraction ring.

As Bandl remarks, it is hardly to be thought that so mighty an alteration could be wrought in the small cervix in the few hours of labor. Aschoff describes a portion of the uterus—an isthmus—between the corpus and cervix, partaking of the character of both, and claims that this forms the lower uterine segment. The literature on this subject is immense, and on reading it one is struck with the lack of uniformity in nomenclature, in the lack of anatomic basis for the various divisions of the cervix and corpus uteri graviditatis, and with the superficiality of many of the examinations of the specimens.

The os internum of the non-pregnant uterus is easily determined; not so that of the pregnant organ. Not the sharp edge of the mucous membrane of the cervix at the so-called internal os; not the firm attachment of the peritoneum to the uterine muscle; not the location of the circular vein; not the formation of decidua; not the mucin reaction of the cervical glands—distinguishes cervix from corpus, or lower uterine segment from cervix. The most certain difference is the distribution

the muscle-fibers, and Bayer has shown that these alter their position in quite characteristic fashion in the latter weeks of pregnancy.

It is probable, in some cases, multiparæ notably, that the mucous membrane and a few layers of muscle—mostly circular—of the cervix remain unchanged until near the advent of labor pains. This gives the sensation of a long canal and closed internal os, a condition well known to Bandl. It is just as probable that the *outer layers* of cervical muscle are drawn up and expanded during the latter months of pregnancy, to form part of the uterine cavity—the so-called lower uterine segment. The upper boundary of this zone is the "contraction ring," or

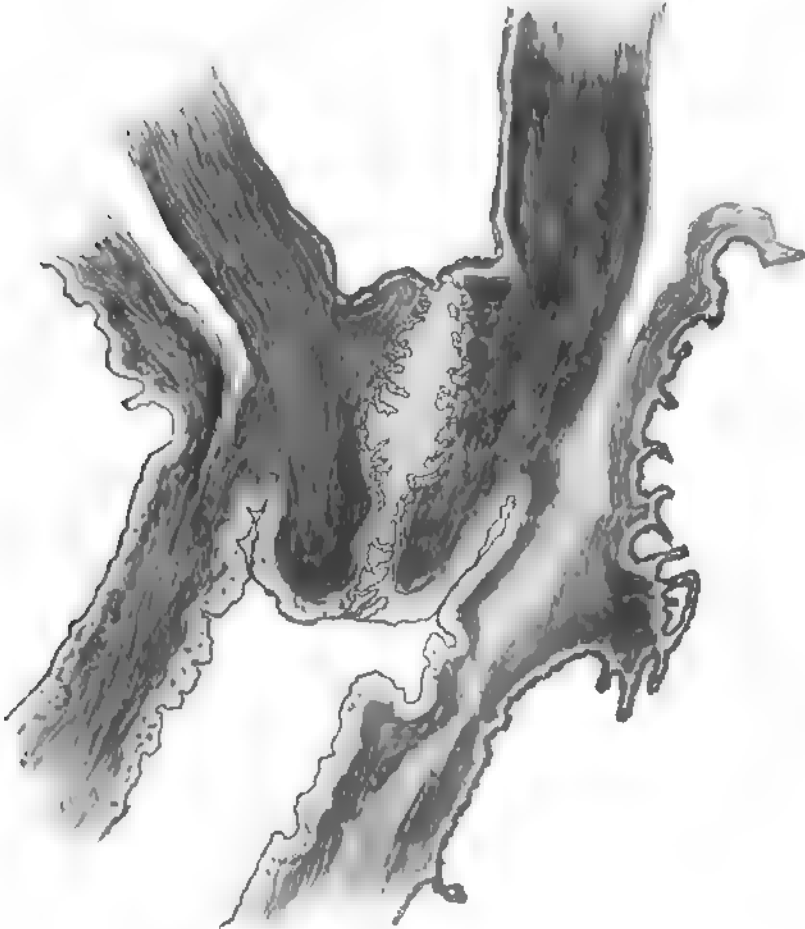


FIG. 124.—CLOSED CERVIX IN A PRIMIPARA AFTER PAINS HAD BEGUN. CONDITION PATHOLOGIC (Bayer).

lower edge of the contracting muscle of the corpus; the lower boundary is the so-called internal os of the cervix, the edge of the cervical mucous membrane. This is sometimes covered with decidua, but the membranes are loosely attached to it, showing its late formation. It has little, if any, contractile power. The mobility of the muscular layers on each other permits the employment of cervical rings for the formation of the lower uterine segment. It is probable, too, that sometimes, oftener in primiparæ, the cervical mucous membrane is also drawn up into the lower uterine segment. In this case one finds portions of the plica palmatæ protruded out in the lower uterine segment, and one may even find the mucous mem-

brane changed into decidua. It is certain that sometimes the cervix remains unchanged, except to soften and hypertrophy, and tightly closed until the advent of hard labor. These cases are, according to Bayer, pathologic, and the author agrees with him (Fig. 123).

That the changes in the cervix during pregnancy are not constant and typical will not surprise him who remembers the variously sized and shaped cervixes he meets in the routine of gynecologic examinations, and one must agree with Bayer that sometimes the cervix unfolds in pregnancy and sometimes it does not.

During labor the differentiation in the uterus becomes marked and unquestionable. The corpus contracts strongly, the lower uterine segment feebly, the cervix not at all; thus two zones are formed—an upper, contracting, and a lower, dilating. In the consideration of the mechanism of labor this subject will again come up.

**Changes in the Physiology of the Uterus.**—During pregnancy the uterus acquires no new functions; those it has, however, are much developed. Menstruation normally ceases during pregnancy.

The sensibility varies in different women. Unless diseased, the organ is not tender. In neurotic patients the lightest palpation, even the fetal movements, evoke pain. In labor the uterus is more sensitive.

Irritability is that property which makes the uterus respond to external stimulation by contracting. Pregnancy develops this quality, but it also varies in different women. In some the ordinary abdominal examination evokes contractions; in others most powerful external and internal stimuli produce little, if any, effect. This is best observed when we try to bring on labor.

The dilatability of the uterus increases very much during pregnancy, and even when the uterus seems well filled by the ovum it can still stretch to hold a considerable amount of extra fluid. This is shown by the enormous acute distention in polyhydramnion and in the accumulation of large quantities of blood in cases of *abruptio placentæ*.

Contractility increases as pregnancy advances. Acting on impulses coming through the nervous system and the blood, the uterus contracts and relaxes. We note this power in the unimpregnated uterus when it expels clots, membranes, or fibroids. As early as the fifth week of gestation the contractions of the uterus are perceptible to the examining finger. These are painless, last twenty to thirty seconds, sometimes a few minutes, and may be observed to recur at irregular intervals up to the advent of labor, when they become regular, painful, and more powerful. The contractions are involuntary, but are sometimes affected by the nervous condition of the woman. They may continue postmortem for a brief period.

Retractility is a function of the uterine muscle not fully understood. It is that power which enables the uterine wall to close down on its diminishing cavity. This is brought about by a microscopic felting together of the muscle-fibers and a superimposition of the muscular lamellæ. This power is manifested most markedly in parturition. A retracted uterus cannot be completely re-expanded without danger to its structure. The property of retractility lies either in the muscle itself, or it is evoked through the nervous mechanism—probably the latter, since it seems to be affected by the same influences as contractility.

Elasticity is the ability of the uterine wall to return to a condition of rest after being distended. It must be sharply differentiated from retractility.

The **round ligaments** are part of the uterine muscle, and hypertrophy with it. Late in pregnancy they may be as thick as the little finger, and, owing to the high location of the fundus, they run vertically. When the placenta is situated on the posterior wall, the round ligaments are felt converging toward the fundus on the anterior wall of the uterus, and when the anterior wall is occupied by the placenta, the ligaments are pushed to the sides. The round ligaments contract synchronously with the uterus, and serve to moor the latter organ to the pelvis during labor. In pregnancy no such action is observable except in pathologic cases—as retroversion.

The **uterosacral ligaments** normally vary much in their development and in the place of insertion on the uterus. They too are part of the uterine musculature and hypertrophy in pregnancy. The part played by these ligaments as suspensors of the uterus has been much exaggerated. Normally, they are relaxed and are put on the stretch only when the uterus is drawn or forced down or up. If the displacement is kept up, they stretch and tear. During labor, however, they contract with the uterus, assisting to hold it in the proper axis of the pelvis, and they aid in the dilatation of the lower uterine segment and cervix.

The **broad ligaments** are also strengthened by the addition of muscular fibers, particularly around the arteries and veins. The two peritoneal layers are separated

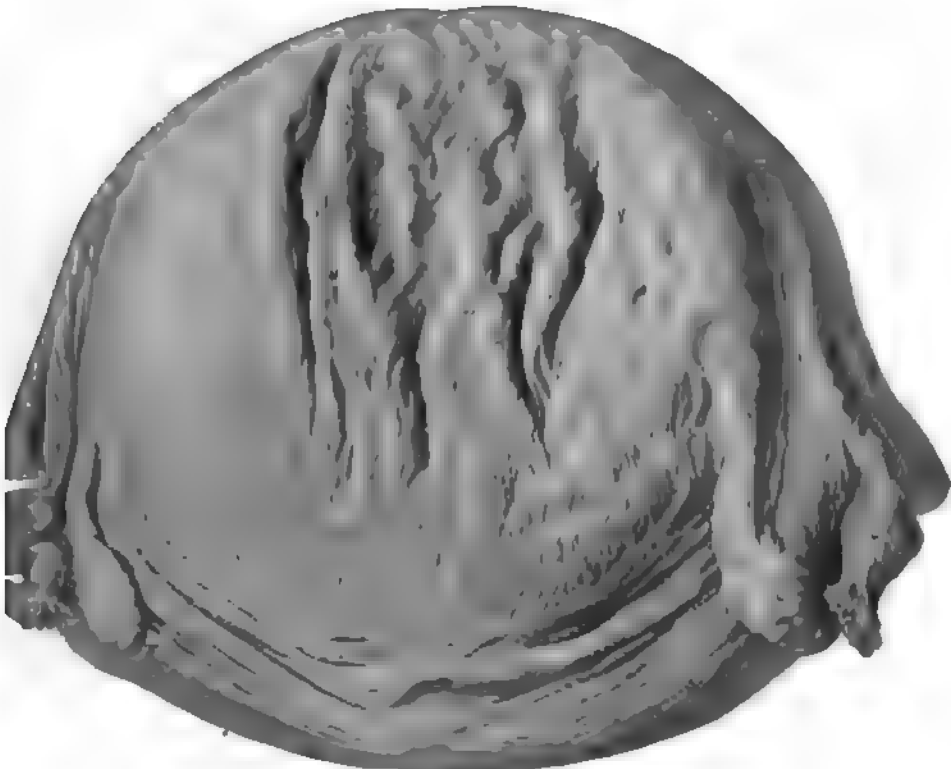


FIG. 125.—GROWING WRINKLING OF UTERUS AT PLACENTAL SITE.  
Specimen kindly loaned by Professor Pisceček, of Vienna.

the development of the uterus, so that a much larger portion of this organ is uncovered at the sides.

The pelvic connective tissue loses its fat; the unstriped muscle-fibers develop more abundantly in it; the lymph-spaces are larger; there is a serous imbibition of all the tissues, and the whole pelvis is congested and more succulent. Immense veins develop in and around the vagina and cervix, sometimes to a pathologic extent. The sides of the uterus may bulge with soft venous swellings. During labor these may burst, forming hematomata and hematoceles, and after labor they may thrombose and give rise to emboli and phleboliths.

The **peritoneum** grows with the uterus, a true hyperplasia occurring. In pathologic cases the peritoneum may not grow, and tears result. After delivery the peritoneum lies wrinkled in more or less typical directions on the contracted uterus, corresponding to the course of the muscle-fibers (Fig. 125). Walker, in 1887, and Schmorl called attention to decidua-like growths on the peritoneum of



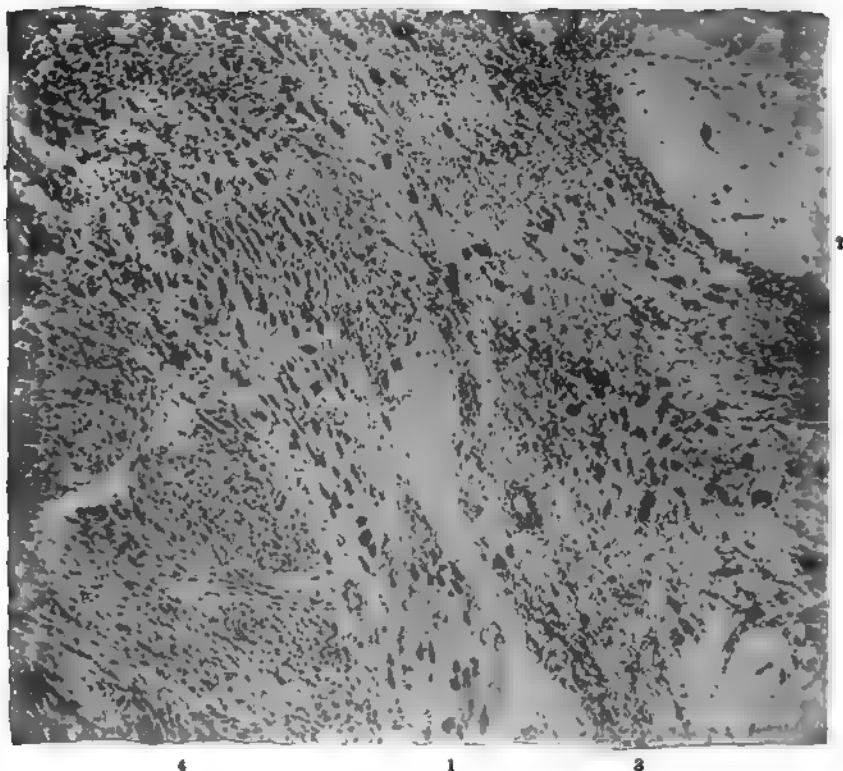


FIG. 126.—LOW-POWER SECTION OF UTERUS.

1, Invasion of Langhans' cells; 2, hyaline degeneration of muscle; 3, round-cell infiltration; 4, normal uterine muscle.

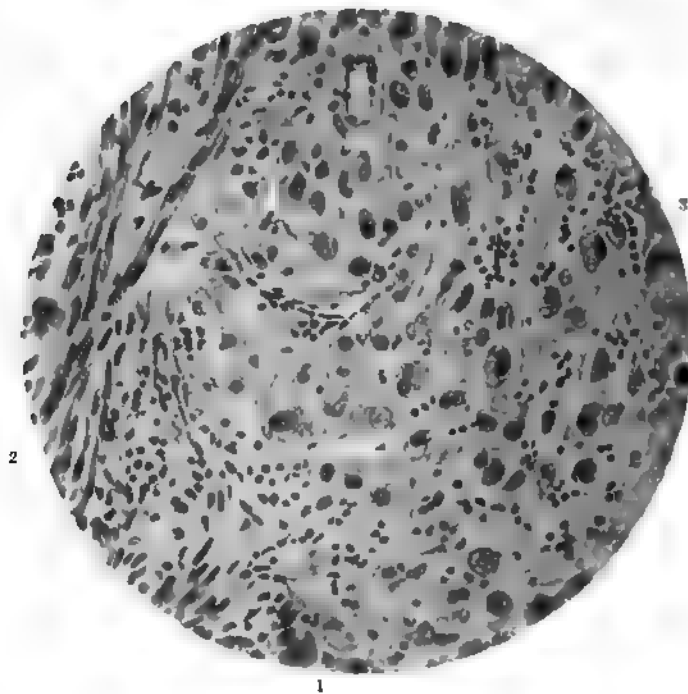


FIG. 126a.—HIGH-POWER SECTION.

1, Langhans' cell invasion; 2, few strands of uterine muscle; 3, round cells.

Figures 126 and 126a are from a specimen removed from a normal uterus at cesarean section. They show how the uterine muscle is invaded by a mass of cells resembling those of the decidua type of syncytioma malignum (see Figs. 483, 484). The neighboring muscle is hyaline degenerated, and one can easily see how it might rupture. The significance of this specimen is much broader than in its bearing on ruptured uterus.

**Douglas' culdesac**, the posterior wall of the uterus, the tubes, ovaries, and omentum. The author has found them on the uterus and anterior abdominal wall in cases of **sarcan section**. They may be 2 to 3 mm. thick, are just under the endothelium, lying it up, resembling miliary tubercles, and may be pedunculated. They may be cystic or even calcareous. (See Fig. 126.) One finds these structures from the third to the tenth month, and the remains persist for several weeks after delivery. They are commoner after inflammations and irritations, and are due, according to Meyer, to ovarian hormones. Their microscopic structure resembles **astases of Langhans' cells**, and this, indeed, Zeit holds them to be.

**The tubes**, which ordinarily vary in length from 5 to 19 cm., are stretched out in pregnancy, hanging almost perpendicularly at the sides of the uterus. There is **hypertrophy** of the muscle-fibers, but much increased vascularity and succulence. A moderate decidual change of the mucous membrane has been observed even with extra-uterine pregnancy. The uterine end is usually closed, but the fimbriated end is open. The patulousness of the tubes is closely associated with the question of the possibility of superfecundation.

**The ovaries** are enlarged, especially the one containing the corpus luteum. In the early months the corpus luteum may be palpated—of course, only in favorable cases. In the later months one may feel the ovary through the abdominal wall hanging on the side of the uterus. The right one is less easily felt. They are always quite tender. The microscopic changes in the ovary are edema, vascularization, decidua-like formations under the tunica albuginea. Ovulation does not invariably cease during pregnancy, as was formerly taught.

**The vagina** increases in length and capacity by a real eccentric hypertrophy. It becomes more distensible, the elastic fibers increasing in amount, and the tissues becoming infiltrated with serum. The rugæ deepen, the papillæ swell, so that sometimes they are palpable as small granules. In pathologic cases a vaginitis granulosa may develop, and in cases of gonorrhea the surface may feel like a nutmeg-grater. The veins enlarge, the venules also, giving the surface a deep wine color (diagnostic of pregnancy), and this engorgement is attended by pronounced secretion or leukorrhea.

The upper portion of the vagina enlarges as pregnancy advances, so that in the later months it is usually possible to touch the sides of the pelvis with the stretched fingers or a dilating pelvimeter. When the uterus ascends, the vagina is drawn up; when the head enters the pelvis in the last month of pregnancy, the vagina is pushed down and often thrown into the circular folds, which may simulate the dilating cervix (Fig. 118). The *angulæ vaginæ* become slightly movable. The anterior vaginal wall and thickened urethrovaginal septum may prolapse through the patulous vulva. Similar changes are seen on the vulva—softening, dark coloration, varices, pigmentation, thickening, enlargement, increased secretion of all its glands.

**The pelvic floor** takes part in the general imbibition of the pelvis. The levator ani becomes less rigid, more distensible. The fat in the ischiorectal fossa is partly absorbed by the end of pregnancy, but the infiltration with serum causes a pronounced swelling and sagging of the perineum. This sagging of the perineum below a line drawn from the under surface of the pubis to the tip of the sacrum is called *pelvic floor projection* (Fig. 127). Other conditions cause an increase of pelvic floor projection, such as pelvic tumors, marked intra-abdominal pressure, but in pregnancy it is most manifest, and in cases of incarceration of the gravid uterus one meets the greatest depression of the tissues. The pelvic floor projection during labor will be considered later.

**The bladder** is much concerned in the changes wrought by pregnancy. In the early months the fundus uteri lies upon it, but with no greater weight than the intestines. A certain amount of traction is exerted by the retroposed cervix on the neck of the bladder, and this, with the congestion of the parts, explains the fre-

quent urination complained of by the women at this period. Cystoscopically, the indentation made by the fundus uteri is easily discovered; the color of the interior is darker, and one experienced in the use of the instrument may suspect the preg-



FIG. 127.—PELVIC FLOOR PROJECTION (adapted from Hart and Barbour).  
Red indicates the parts before pregnancy

from the appearance of the congested and newly vascularized bladder mucosa. In the base of the bladder are sometimes found dilated veins. In the later months they give rise to hemorrhage. Even after the uterus has risen into the abdomen the bladder remains a pelvic organ, unless distended, when it is flattened out

rest the abdominal wall. In these cases the bladder assumes a saddle shape, rising up to either side of the uterus—more toward the right. This is determined by the cystoscope or by illuminating the filled bladder and observing the abdomen in a dark room. The area of redness on the belly-wall shows the outline of the bladder. With the development of the lower uterine segment the attachment of the bladder to the uterus is loosened and the bladder is stripped off the wall in the latter. In labor the uterus retracts still further away from the bladder—sometimes so far that the latter comes to lie on the vagina. These facts were determined clinically in cases of extraperitoneal cesarean section. During the latter part of the first stage of labor the peritoneum of the anterior culdesac may be partly stripped off the bladder. When the head enters the pelvis in the last month, it compresses directly on the bladder or distort its base, thus giving rise to the frequent urination so often noted. Perhaps the diminished capacity of the organ is also causative. The bladder, flattened between the head and pelvis, bulges out on either side, especially the right, when filling.

The **ureters** are enlarged early in pregnancy. Thickening is one of the diagnostic signs. They are displaced to the side of the pelvis, and may be felt on bimanual examination as two cord-like, tender structures, coursing between the cervix and the pelvic wall. Late in pregnancy they may be felt lying against the lower uterine segment and the fetal head. Halbertsma claimed that the ureters frequently suffer compression during the later months of pregnancy, and that eclampsia is due to the backing up of the urine. At no time can the uterus directly compress the ureters, for further, the weight of the uterus is not greater than that of the intestinal mass. The entry of the fetal head into the pelvis in the last month distorts the course of the ureter or kinks or stretches it, and this may interfere with the passage of urine. Endoscopically, the ureteral openings in the bladder appear elevated, thickened, and deeply congested.

The **pelvic girdle** is affected by the changes of pregnancy. The author has determined an actual increase of the size of the pelvic cavity. Measurements taken of contracted pelvis before conception, and just before labor, will often show this, and women in whom labor was predicted as impossible may have spontaneous or operative deliveries. The constitution of the pelvic bones during pregnancy is altered similarly to the pathologic osteomalacia. Occasionally there is an irregular deposit of extra bone under the periosteum—the puerperal osteophytes of Sitansky.

The pelvic articulations undergo marked changes. Hippocrates knew that the joints softened and became looser, and he believed that parturition was difficult if this relaxation did not occur. Perhaps part of the enlargement of the pelvic circle now mentioned is due to the thickening of the cartilages of the joints. Normally, even in man, there is a slight movability of the pelvic joints, but in pregnancy this is increased and during labor it is greatest. The tissues of the joint imbibe fluid, the synovial membrane thickens, the vascularity is increased, and there is an augmentation of the osseous tissue. It is to be noted that these changes are most marked in women with varicose veins of the pelvis. The pubic, sacrococcygeal, and sacro-iliac joints are affected in the order named. In guinea-pigs these changes are part of the pregnancy and parturition, and may be so pronounced that the bones of the pubis may separate so far as to allow the animal's legs to lie alongside the body on the table. The "sinking of the rump" informs the veterinarian that delivery is at hand. In women an actual enlargement of the pelvis in labor occurs only in very slight degree, but the softening of the joints allows free motion of the bones and thus a new configuration, which facilitates the delivery.

Many women in the later months of pregnancy complain of pain in the pelvic joints, a waddling gait, and difficulty in walking. Examination will usually show tenderness over the pubes, and riding of the two bones on each other when the pelvis

is strongly rocked from side to side, or even a groove showing a larger degree of separation. (See Relaxation and Rupture of the Pelvic Joints.)

The abdominal wall distends as the pregnancy advances, and grows thinner, especially around the navel. Experiments by Kraus have shown that the tension is in the direction of radii from the navel. In primiparæ the abdominal walls are tenser and sag less than in women who have borne children. Sometimes the linea alba gives way to the strain, the recti muscles separate, and the pregnant uterus falls forward between them, covered only by a thin layer of skin and peritoneum. This is called "rupture" by the laity. The belly becomes pendulous,—"*ventre en berce*,"—and not seldom the condition gives rise to dystocia. Any tendency to hernia is aggravated by pregnancy, but, during the period the uterus usually pushes

up and keeps away the gut and omentum from the hernial openings—that is, unless these are adherent to the sac.

In 90 per cent. (Credè), and in practically all cases of the author, the skin shows smooth, silvery, or pearly white or violet broad lines, called striae or lineæ albicantes gravidarum. The lines are curved, irregular, sometimes confluent, and show a fine transverse fibrillation. They are arranged more or less concentrically, but sometimes radially around the navel, especially on the lower abdomen. Near Poupart's ligament they are always broader and deeper in color. One finds them on the nates, the



FIG. 128.—STRIÆ GRAVIDARUM  
From a photograph, Chicago Lying-in Hospital.

thighs, more on the anterior aspect, but sometimes on the posterior too, and as far down as the knees. The breasts also show them, arranged radially to the nipple. Blondes are more affected than brunets, primiparæ more than multiparæ, fat women more than lean, large women more than small, young women more than those older than twenty-five. The number depends also on the degree of abdominal distention and the use of abdominal supporters, but there are other factors in the causation than mere abdominal distention, because in cases of immense abdominal enlargement due to ovarian tumors or ascites the striae are not constant. Formerly they were considered positive proof of preëxisting pregnancy, but this is not true, since they occur in the following conditions: rapid accumulation of fat at any period, as at puberty; they are found in men (6 per cent.); dropsy and ascites; abdominal tumors; unusually rapid growth of the long bones may develop them at the epiphyses; after typhoid fever. If the lineæ are marked and with typical distribution, the presumption of previous pregnancy is strong, but never certain. The author has seen striae on the breasts of a virgin. New striae may appear among the old.

The author has observed lineæ gravidarum in the sixth month. Histologically, one

the connective tissue of the cutis and subcutis stretched, sometimes torn, and the former rhomboid arrangement of the fibers changed to a more parallel disposition of the strands across the striæ. The elastic fibers are always torn, and the red ends found at the edge of the striæ. The lymph-spaces are compressed and run parallel. Perhaps this explains the tendency of the lines to become dropped.

The papillæ are flattened, sometimes completely, and are also arranged in regular rows. The epidermis is thinned. In brunets and colored women there is a tendency to pigmentation of the striæ. Stratz says that savage women do not stretch, and advises massage with oil as a preventive. (See Taussig.)

**The Physics of the Abdomen.**—The pressure in the belly varies very little from the outside, and depends on the tonicity of the abdominal walls. In the relaxed supine position the abdominal walls support a pressure equal only to the weight of the viscera, which, being practically semifluid, seek the lowest portions of the abdomen. In this position there is a slight increase of intra-abdominal pressure with inspiration, and a slight decrease during expiration.

In the erect position there is a slight increase of intra-abdominal pressure because the muscles are on tension, and this is augmented by inspiration, expiration, as by exercise, exertion, efforts, defecation, vomiting, etc. The development of tumors in the belly, as fibroids, cysts, etc., increases intra-abdominal pressure. In addition the lower parts of the abdomen, in the erect position, sustain the weight of the superimposed column of viscera. There is more intra-abdominal pressure at the bottom than at the top. The changes in the pressure brought about by respiration are transmitted throughout the abdomen, and are felt on the perineum and organs within the pelvic floor, uterus, and rectum. The organs in the belly are held in position by atmospheric pressure. They are fastened to the firm parietes by ligaments.

Supported on each other, getting indirect support from the abdominal muscles and pelvic floor. In the knee-chest position the weight of the liver and intestines pressing toward the chest produces a negative pressure in the abdomen. If, now, the mouth, vagina, rectum, and bladder are opened, air rushes in and distends them. This position is therapeutically useful.

**The Breasts.**—In the embryo of six weeks there is found a line of cells running from the axilla to the groin, and called the linea or crista lactea. From the chest end of this the breasts develop. Accessory breasts and supernumerary nipples are most always found in this line on either side, and indicate a tendency to revert to a lower order in human development.

An ingrowth of epithelial cells, which later become tubulated, marks the site of the future mammary gland. In the fetus at five months the gland consists simply of a collection of cells which open at one spot—the future nipple. This spot is depressed; thus the future nipple in the adult is simply one retarded in development. Even at five months the ducts are branched, and at term they divide two or three times.



FIG 129 BRUNET'S BREAST. PREGNANCY, EIGHT MONTHS. Shows primary and secondary areolæ.

These primitive ducts represent the future lobules. Hardly any acinous structure exists at birth, but the tubules are capable of secreting milk and colostrum which do not differ in composition from those of the mother. The growth of the gland is very slow until puberty. Then acini develop in the primitive tubules, each of which becomes a tubuloracemose gland, and thus the breast comes to be made up of distinct lobules embedded in a fat cushion. Each lobe empties on the surface of the now prominent nipple by a duct. Before opening on the nipple each duct dilates a little—the sinus lactiferus. There are 15 to 20 ducts. The nipple is a muscular organ, and is covered by delicate pigmented skin, is quite vascular, and at the base is surrounded by unstriped muscle-fibers which unite with those of the nipple itself and thus produce the erection of the same. For a varying distance around the nipple the skin is very delicate, more or less pigmented, and raised from the fascia covering the mammary gland by soft connective tissue and fat. This is



FIG. 130.—VARIOUSLY SHAPED BREASTS  
(PRIMIPARAE)

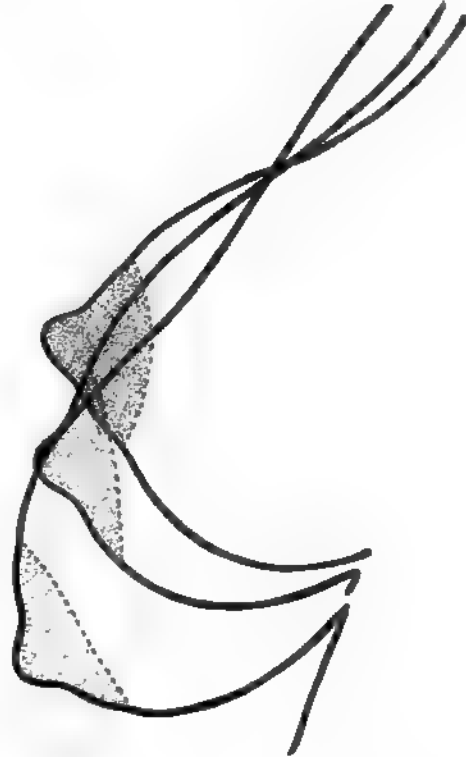


FIG. 130g.—VARIOUSLY SHAPED BREASTS (MULTIPARAE)

the areola. Embedded in this areola lie tiny milk-glands, Montgomery's tubercles, each opening on the surface by a microscopic duct. Sebaceous and sweat-glands are also found.

With the advent of pregnancy the glands take on renewed growth, and as early as the second month a change may be noted. The breasts increase in size and sensibility; the hard, tense feel of the virgin gland is lost; it softens and sags. The lobules become more marked, due to enlargement, development of acini in the periphery, and softening of the connective tissue and fat around them. The acinous formation on the tubules in the center of the gland is especially marked during pregnancy, there being both hyperplasia and hypertrophy. The veins enlarge and are seen as bluish streaks, especially at the periphery, and here striæ often (67 per cent.) develop. Hypertrophy of the lymph-system is also a feature. The

ipple becomes more erectile, and, with the areola, becomes more deeply pigmented. The base of the areola becomes puffy, raising the surface above that of the rest of the gland, and the milk-glands of Montgomery enlarge prominently. Occasionally a droplet of secretion may be expressed from them. Around the primary areola, specially in brunets, a secondary areola, less pigmented, sometimes develops. It resembles "dusty paper sprinkled with drops of water." The clear spots are due to lack of pigment around the openings of sweat and sebaceous glands. From the early months—and the time varies—a little clear, sticky fluid may be expressed from the nipple. Later this is mixed with yellow material. It is called colostrum. Often it oozes out and dries into branny scales on the nipple. Unless cleaned off, these sometimes decompose and give rise to sore nipples, even in pregnancy.

The shape of the breast varies much in women, and also at different periods of life. In young, non-pregnant women they sometimes are hemispheric and prominent. In old women and in the later months of pregnancy they are pendulous. In some colored races they are like long sacs, and they may be hrown over the shoulder, for a child, carried on the back, to nurse from. Some breasts are large, others small, which depends on the amount of gland tissue and fat, of which there is sometimes more of one than of the other. The right breast is sometimes larger than the left, and vice versa.

The mammary glands may be considered modified skin-glands, with a fetal origin similar to the sebaceous glands (Basch). Sometimes we find supernumerary glands and nipples above and below the normal one. This is called polymastia, and is rare. Accessory glands and nipples are usually found in a line running from the axilla onto the abdomen—the crista lactea already referred to; this and embryologic studies indicate that man had at one time a line of glands similarly to some of the lower animals. Up in the axilla there is often an aberrant piece of the mammary gland, which sometimes swells and becomes painful when lactation starts. It is often mistaken for a lymph-gland. It may enlarge outside of pregnancy. The sweat-glands in the axilla, too, are often enlarged and palpable, secreting freely. (See Knaebel.)

When the child is delivered and lactation begins, the breasts reach their highest development, but we will leave the consideration of this until we discuss the changes of the puerperium. Starling believes that the growth of the mammae during pregnancy is due to the action of a "mammary hormone," developed in the growing fetus, carried to the breasts by the blood, and there acting specifically on the gland-cells. Steinach believes the influence comes from the ovaries because he got the breasts to secrete in castrated male rats into which he had transplanted ovaries. Hammond says it is the corpus luteum first stimulating the growth of the breast, then the secretion of milk follows in correlation to its involution. In the Blazek united twins, though only one was pregnant, in both the breasts were enlarged and secreted milk. The breasts possess an internal secretion which seems to inhibit ovarian activity, and, if produced in too large amounts, may cause atrophy of the uterus, the lactation amenorrhea. Extracts of the mamma have been employed therapeutically.

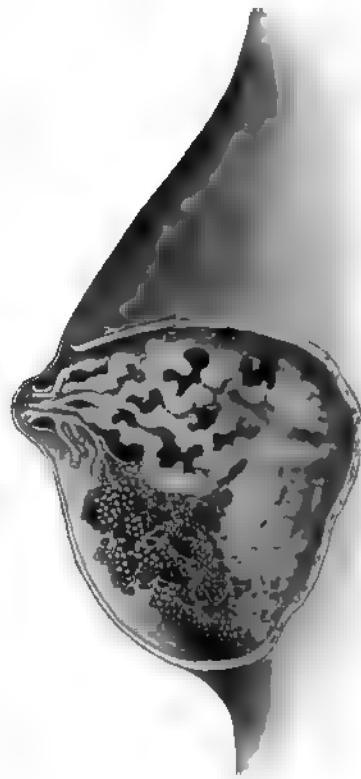


FIG. 131.—FUNCTIONATING BREAST, MOSTLY DIAGRAMMATIC.



The alkalinity of the blood is slightly diminished, but the freezing-point is the same as in the non-pregnant state  $-0.55$  to  $-0.59$ . The fibrin and fibrinogen increases from the sixth month of pregnancy, and is third greater than usual. This increase of fibrin is probably a conservative nature to prevent dangerous loss of blood during labor. Perhaps the causes the thromboses sometimes observed in the veins of the leg and before labor. When such thromboses give rise to emboli, sudden death

Rebaudi says that the blood-platelets increase up to the time of labor, 1,000 per c.mm., then rapidly decrease to 600,000. Their agglutinating power increases with the number, therefore the coagulating power of blood is less before labor. May the increase of the adrenalin content partly account

for the increase in the quantity of blood is augmented, especially in the last months, a true anemia existing (Spiegelberg and Gscheidlen and Zuntz), a fact recently (1915) confirmed by Miller by means of the "vital red" method, the volume being reduced 9½ per cent. of the body weight. The need for more blood must be met by the addition of the fetus and the fetal circulation, the development of new arteries and veins, the enlargement of the veins of the lower extremities, sometimes so great that they appear to be veritable caverns. It would seem that they act as reservoirs and provide for the loss of blood at labor. Often a quart at this time creates no symptoms. The distended veins collapse after delivery. Chauffard, in 1911, found an increase of the cholesterol in the blood, in the seventh month a true cholesterinemia. Aschoff believes this may explain the formation of gall-stones. Lipoids in the blood are increased, also the antitryptic activity of the serum (Ecalé, 1917). The resistance of the reds to hemolysis by hypotonic solutions is diminished (von Graff, 1912). The Wassermann reaction becomes negative during pregnancy. A slight acidosis is normal.

Blood-making organs show marked activity. The spleen grows from 140

The lumbar glands enlarge, also the lymphoid structures of the endocrine system. The lymph-glands all over the body are frequently enlarged in pregnancy. The thyroid becomes more vascular, often hypertrophies. The enlargement is noticed after the sixth month, and may disappear only partly after delivery. Lange claimed that the thyroid has an influence on pregnancy and especially on toxemia and eclampsia. It has something to do with the growth of

the thyroid, sometimes to the point of producing symptoms of hyperthyroidism. The parathyroids are also affected. Comptes, in 1899, first described the hypophysis cerebri hypertrophied during pregnancy, a fact confirmed by Kohn in 1910. The chromophile cells are not affected, the chromophobes are reduced, and sometimes the anterior lobe may become so large that it presses on the optic chiasm, causing hemianopsia. An extract of the posterior lobe of the body, administered hypodermically, stimulates uterine contractions. The symptoms and changes in pregnancy are acromegalic in nature, *e. g.*, enlargement of the hands, feet, nose, hair, larynx. The interaction of the internal secretions of the endocrine glands is not at all well understood, but its study offers a promising field of research. Neu (1911) claims that "adrenalinemia" exists in pregnancy.

In the marrow of bones decided changes have been noted. Great congestion and transformation of fat marrow to blood-forming marrow have been found. In the marrow of the skull, along the middle meningeal artery and longitudinal sinus, and in the long bones, and occasionally elsewhere, one may find thin deposits of reddish

They are 1 to 2 mm. thick, and each pregnancy brings a new layer. They are called them "puerperal osteophytes," and believed they had some work to do in the blood making during pregnancy. They occur only in one-half of the pregnancies that go to autopsy, and are not characteristic because they are also found in syphilis, tuberculosis, and chronic hydrocephalus.

**The Circulatory System.**—The changes here are marked, the whole cardiovascular system being affected, though not in the same degree as was formerly believed. Larcher, in 1857, described an eccentric hypertrophy of the heart, especially of the left ventricle, Blot and other French authors agreeing with him. A mass of literature has accumulated on the subject. Later investigations (Müller and Dreyse) considering the weight of the body with that of the heart have shown that there is only a slight if any enlargement, and that it is proportionate to the general increase of the body. The arguments for accepting the theory of hypertrophy are, first, the physiologic need for more work by the heart; the increased amount of blood to be moved; the increased viscosity of the blood; the addition of the large area of blood-vessels of the placental circulation, and the dilated and new blood-vessels of the uterus; the increased abdominal tension; second, the results of postmortem measurements, the majority of authors finding some increase in weight; third, the clinical findings. There is an increase in the area of cardiac dulness, but Gerhardt claims this is due to the elevation of the diaphragm and resulting leveling of the heart. Röntgen-ray examination of the chest in pregnancy (Kraus) shows two types—one with long thorax, a convex diaphragm, and undisturbed heart, another with short thorax, raised and flattened diaphragm, and heart placed horizontally. The heart in all cases is pressed against the anterior chest-wall, displacing the lungs; thus the area of cardiac dulness is enlarged.

Many pregnant women have high arterial tension, or a larger or more frequent pulse-beat, but there is nothing in the pulse of pregnant women that is characteristic or different from other women (Vejas). Once in four cases one hears a systolic murmur over the base of the heart, not transmitted far, and not always accompanied by accentuation of the second pulmonary sound. It is usually hemic in origin, but may be due to displacement of the heart kinking the pulmonary artery, and almost always disappears shortly after delivery. One must be slow to diagnose heart lesions in pregnancy, but it is generally admitted that the heart is peculiarly liable to disease during gestation, and that existing disorders are aggravated.

The *blood-pressure* normally is 110 to 120, with 75 to 85 diastolic, subject to the usual fluctuations. The blood-pressure should not go above 150 mm., and even this advises caution, as indicating toxemia. During labor the blood-pressure is a little higher (130 to 140), especially during the pains (140 to 145). After the rupture of the membranes the pressure falls 40 to 50 points, but rises at once. It is highest during the expulsive efforts of the delivery, falls in the third stage (60 to 90 mm.), especially if there is hemorrhage, rises again after delivery, and slowly returns (in thirty-six hours) to normal during the puerperium. (Slemons, Irving).

A frequent complaint by pregnant women is of fainting spells. There are also attacks of palpitation with a sense of suffocation. These phenomena are usually due to a disturbed nervous system, hysteria, tight lacing, a full stomach, constipation, or the toxemia of pregnancy.

Pregnant women have a marked tendency to develop varicose veins of the lower half of the body. Nearly every one has at least one or more phlebectasia. In 20 per cent. of the cases the varicosities are marked. The usual sites are the legs, the vulva, the mons, the pelvis, the rectum, the anus, the vagina, the abdomen, buttocks, in the order named. One or more or all the parts may be involved; usually the right, may exceed the other in the size and number of the varicosities.

The surface veins are most affected. Of causes, several are given; increased venous congestion below the diaphragm, caused by the greater intra-abdominal tension of pregnancy; obstruction in the vena iliaca communis, due to the pressure from the enlarged vena hypogastrica; disturbed vasomotor conditions; an increase in the total amount of blood, and enlargement of the veins to accommodate the increased blood; a congenital anomaly of veins brought out by pregnancy; a toxic alteration of the vein wall. Predisposing causes are: Thin-walled veins, heart disease,

t girdles and garters, constipation, carrying heavy loads, frequent pregnancies. The state of pregnancy undoubtedly has mainly to do with the development of varicose veins, because increased abdominal tension may exist without their occurrence, as in large ovarian tumors, ascites, etc. Parvin tells of a patient who knew she was pregnant as early as four weeks by the development of varicosities in the legs. Sometimes varicose veins shrink when the fetus dies. Compression of the cava by the uterus does not cause stasis in the veins below, because the specific gravity of the uterus is about the same as that of the intestinal mass. After the head has descended into the pelvis it may compress the internal iliac and hypogastric veins, but



FIG. 132.—VARICOSE VEINS OF VULVA.  
Drawn from a photograph.

does not often observe much difference from this unless there have been marked varicosities previously.

Edema is often associated with varices of the legs and has the same causes. It may occur alone, and may have other causes. Three kinds may be distinguished—mechanical, due to the obstructed venous circulation in the abdomen, which appears when the patient rests in the horizontal position; a general puffiness swelling the hands and face, as well as the legs, without urinary findings, commoner in chronic patients, and which disappears rapidly after labor; a true anasarca, due to toxemia or nephritis, and always significant as a precursor of eclampsia. Usually the latter two forms are allied. The edema of the legs may be enormous; the labia majora may be so infiltrated as to be translucent and as large as the fist; the swollen abdominal wall may hang down like a bag.

The lungs are displaced by the growing uterus. They retract to the sides, exposing more of the heart. The thorax is lifted up, is expanded laterally, and slightly diminished anteroposteriorly. Part of this change is permanent. The diaphragm is pushed up, but in fat subjects its upper curve is not convex, but flattened or even slightly depressed by the heart. These changes are more marked in primiparæ than in multiparæ, because of the lax abdominal wall in the latter. The respiration is more costal than abdominal, because of the restricted excursion of the diaphragm. The vital capacity is not decreased, but the respiration is more frequent—24 to 26 a minute. More  $\text{CO}_2$  is excreted. (See Vejas, *loc. cit.*) When lightening occurs at the end of pregnancy, the chest is relieved. Changes which some rhinologists consider characteristic of pregnancy have been described as occurring in the nose and throat. The turbinates are turgid, even to closure of the nares or apposition against the septum. Perhaps these findings will explain the deafness and ringing in the ears some pregnant women have, or even some of the so-called neuroses (Freund). Brickner believes otosclerosis is peculiarly unfavorably affected by pregnancy. There seems to be an interrelation between the nasal cavities and the genitalia (Fliess). The larynx is somewhat congested, especially the false vocal cords, and there is some slight cellular infiltration of the tissues (Hofbauer), the changes being most evident in the interarytenoid fold. Thickening of the pharynx may cause irritative cough.

**The Digestive Tract.**—One of the first symptoms of pregnancy is the nausea and vomiting—the so-called “morning sickness.” It may be present as early as the second week, but usually appears about the fifth, and persists until the twelfth week, though occasionally it continues until term. The patient is sick at the stomach on rising or after breakfast, and vomits the meal or only sour mucus, being free from nausea the rest of the day. The feeling is similar to sea-sickness, and it is aggravated by sudden motion. The vomiting may recur at the end of pregnancy, after “lightening,” due to the displacement of the stomach and intestines, but at this time the vomiting may also be due to toxemia, and mean that eclampsia threatens. Should the nausea and vomiting persist the greater part of the day, the case becomes pathologic. This will be considered under the subject *Hyperemesis Gravidarum*, p. 355. Morning sickness occurs in one-third of pregnant women. Its cause is obscure; perhaps it is a reflex from the uterus, or it may be toxic, or due to disturbed relations of the ductless glands. Primiparæ are oftener affected than multiparæ. It occurs oftener in the higher classes of society and in the neurotic.

The salivary secretion is increased, and when the expectoration is frothy, it is called “cotton spitting.” In some cases the patient is actually salivated; then the case is pathologic and needs treatment. The teeth easily decay, due to the alteration of the secretions of the mouth, dentists say, but perhaps, too, because of the demand of the fetus for more calcareous salts, or the teeth partake of the general changes exhibited by the bony system. Loosening of the teeth may occur. Gingivitis to a mild degree is also observed, but this borders on the pathologic. The taste is sometimes perverted, the gravida having a desire for unnatural things, as chalk, slate-pencils, sand, salt, etc. This symptom is called “pica,” and may become morbid, as in the case of a woman who craved a bite of her husband’s arm, and actually took it. It was considered dangerous to the fetus or mother to oppose these “cravings” of pregnant women, and all sorts of devices were employed to appease them. The appetite is usually increased unless nausea occurs; even then, after the vomiting, the patient is hungry. Some women have a voracious appetite in pregnancy, and often satisfy it to their detriment, in the belief, fostered by many, that they are eating for two. Again, anorexia is present or the appetite is fickle.

The stomach is displaced in the later months of gestation, being forced upward, backward, and to the left. The wall is congested, and pours out abundant watery

The hydrochloric acid is increased, causing frequent "heartburn." is usually more active, and varies with the appetite.

*liver* is forced upward, backward, and to the right in the late months. ness, therefore, must be corrected in this period. Tarnier, in 1857, de-fatty infiltration around the intralobular veins, but this is not constant, ably does not occur in normal pregnancy. The glycogen in the liver is . There is more bile present, and dilatation of the bile-passages, also the central veins. Multinuclear cells, presumably from the placenta, ions of villi, are sometimes found as emboli in the liver vessels. The dis-of the functions of the liver noted by some authors is pathologic, and will ered under proper headings.

*intestines* are also affected by pregnancy. Constipation is almost the rule, to the displacement of the bowels, abnormal innervation, general inac-the *gravida*, interference by the uterine tumor with bearing-down efforts tion. Hemorrhoids are common, from the constipation and the increase pressure below the diaphragm.

**ral Metabolism.**—The body weight increases in the last three months, to Hecker and Gassner: seventh month, 2400 gm.; eighth month, 1690 th month, 1540 gm. This varies in relation to the size of the person, e showing larger gains than *primiparæ*. The increase in weight is due to—tus and *secundines*; (2) increased assimilation; (3) storing up of fat and (4) accumulation of water, especially in the lower extremities; (5) increase ount of blood. A store of potential energy is laid up for conversion into force during labor, and milk during lactation. The hips round off and road; the breasts have more fat. A *gravida* gains one-thirteenth of her ght during pregnancy. If the fetus dies, this gain does not occur or the ay lose weight, and this fact may be used in the diagnosis of the death of

metabolism in pregnancy has been studied by von Winckel, Miotti, and ; little is definitely known. The nitrogen output is decreased, albumin red up. Fat and iron are also stored up. Carbohydrates are rapidly ed, and before labor carbonic acid is excreted in large amounts.

women feel better during pregnancy than at other times, but in some, the anemic and the neurotic, a condition of *asthenia* develops in the early The fetus uses up the iron and calcium. Later the nutrition is better, oman may enjoy a permanent improvement in health from the stimulus ney. On the other hand, some women suffer a permanent *neurasthenia* strain of reproduction.

**Urine.**—The quantity is usually increased about one-fourth. This poly-ains in part the frequent urination of pregnant women. The specific low, total solids and urea output being the same as or slightly less than in regnant state. The sulphates and phosphates do not change; the chlorids n the last months. Albumin is found in one-third of the cases of preg-one uses the finest tests, as acetic acid and ferrocyanid of potash. The and amount increase until labor, when fully 50 per cent. of cases show ria. These figures are from the "*Handbuch der Geburtshilfe*," vol. i, p. 391. s the hot and cold nitric-acid tests, which, for practical purposes, are suffi- will find albumin in only 3 to 5 per cent. of *gravidæ* and 30 per cent. of s. Jaeger found albumin in 70 per cent. of pregnant women, and believes equently of *lordotic* origin, or due to a latent bacterial influence. Many albumin comes from the urinary tract or from the external genitals. Renal ia, in the experience of the author, is rare in pregnancy, and should always on with suspicion. Mild *catarrhs* of the bladder, *pyelitis*, and *ureteritis* common in pregnant women. The highly congested, edematous bladder

may permit the escape of albumin into the urine. The rôle of the "kidney of pregnancy" in the production of albuminuria will be discussed under Toxemia and Eclampsia, in the Pathology of Pregnancy, since the author believes the phenomenon is not normal.

Sugar is occasionally found in the urine during gestation, and is of two kinds—lactose and dextrose. Lactosuria occurs in 16 per cent. of gravidæ (Ney), is more pronounced near labor, most pronounced in the first week of the puerperium (77 per cent.), and disappears after lactation is discontinued, though it may be temporarily augmented by the weaning process. It is due to absorption of milk-sugar from the functioning breasts, and is not an unfavorable sign, unless it is large in amount and attended by signs of disturbed nutrition. (See Literature.) True glycosuria, on the other hand, is more significant, though some authors describe a "physiologic diabetes of pregnancy." Adrenalin glycosuria is more easily produced in pregnancy. Alimentary glycosuria is more likely to occur during gestation because of the decreased glycogenic function of the liver or the diminished assimilating power for sugar, and one finds 0.01 per cent. of grape-sugar occasionally, as one does in men, but with the ordinary tests employed by the practitioner sugar is not regularly found in normal gravidæ. Its occurrence is always a matter of grave concern. (See Diabetes in Pregnancy, p. 518.) Acetone in the minute quantities usually found in women is also determinable during pregnancy. It is increased in amount during hard labor, during the first days of the puerperium, febrile conditions, toxemia and eclampsia, syphilis, ectopic gestation, and death of the fetus, but is not pathognomonic of this. Peptone, according to Fischel, occurs in 25 per cent. of gravidæ and 96 per cent. of puerperæ. It probably comes from the absorption of the fatty degenerated uterine tissue during involution, and has no proved bearing on the metabolism of the fetus, the lochial discharge, or the fermentation processes of the intestine. It occurs in sepsis, acute yellow atrophy of the liver, toxemia, and eclampsia. Bar claims that the urine shows increased excretion of lime, and draws this into relation with the bone changes of pregnancy.

**The Bones.**—Reference has been made to the thin, porous, soft bony deposits on the inner surface of the cranium—the puerperal osteophytes. Their function is unknown; probably they have to do with the blood changes of pregnancy, but it has been suggested that they have a relation to the bony formation of the fetus.

The bones in pregnancy show increased vascularity, especially the red marrow, and to a certain extent resemble the changes found in osteomalacia. Indeed, a physiologic osteomalacia of pregnancy has been described (Hanau). Fractures unite well in pregnancy, contrary to an old notion. The joints of the pelvis soften, as has been mentioned (p. 101). In several cases of young women the author has observed a rapid growth of the pelvic bones during pregnancy, increasing materially the capacity of the pelvis.

The spinal column is straightened, the uterine tumor, prominent in front, changes the line of direction of the woman's person. This line of direction tends to fall anterior to her base of support. Therefore she throws her shoulders back and straightens her neck and head. The curve in the small of the back is exaggerated (Figs. 133 and 134), the pelvis being rotated slightly on the femora. These changes in the skeletal dynamics give the patient a peculiar attitude and gait or strut, which Shakespeare called the "pride of pregnancy." With marked softening of the pelvic joints, however, the patient has a waddling gait, because the innominales move on each other. In cases of pendulous abdomen and with twins the changes in the attitude of the gravida are exaggerated. (See La Pointe.)

The skin is much affected by pregnancy. Pigment is deposited in more or less typical regions—the nipples, the vulva, the linea alba, the navel, the face. The pigmentation of the linea alba changing it to a linea nigra, of the nipples already

idered and of the face is most common. The forehead, cheek, and nose are red with brown stains which cannot be wiped off. They, when marked, appear like a mask, and the condition has been called "the mask of pregnancy" (Fig. . This deposit of pigment in the rete cutis occurs oftener in nervous women rose suffering from uterine disease. Occurring outside of pregnancy, it is called *asma uterinum*. Brunets are more affected than blonds. Women of careless

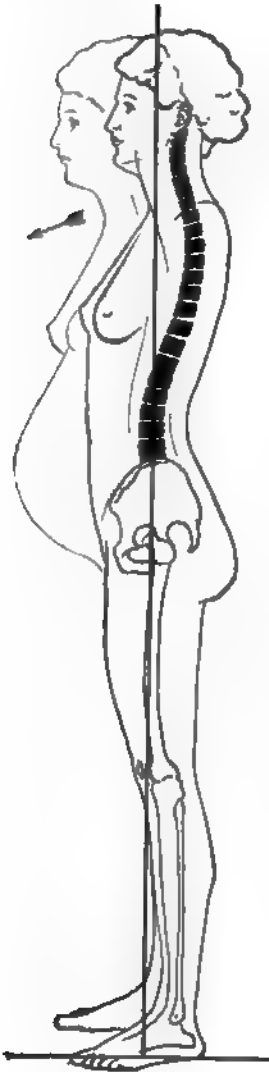


Fig. 133.

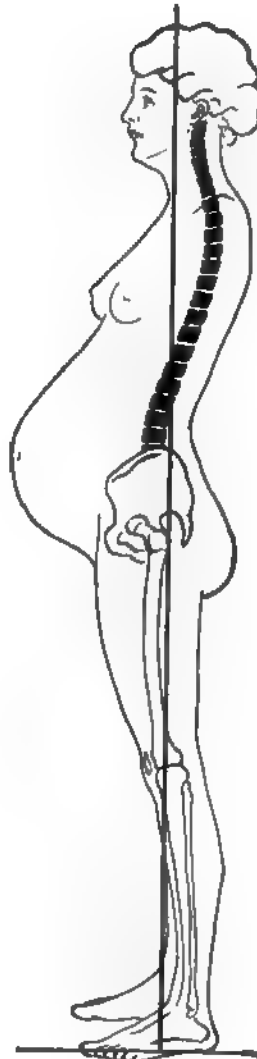


Fig. 134.

FIGS. 133 AND 134.—STATICS OF THE NON-PREGNANT AND PREGNANT WOMAN. Indicates direction of tendency to fall as abdominal tumor develops. Second figure shows effect of the adaptation.

onal habits are more prone to manifest this sign, lack of attention to skin and els being a factor. The actual cause of the deposits is unknown—slow circula- in the capillaries, especially at the junction of the embryonal folds, hypertrophy he suprarenals, active destruction of the red blood-corpuscles, abnormal iron abolism, hepatic disturbances, and neurotic influences having all been invoked. ording to Samuely, the pigmentation is due to the action of a ferment, tyro- se, on the tyrosin in the blood during exposure to sunlight. Both the Blazek

psychoses are not uncommon, especially if there is a family taint. These may be the expression of a toxemia, as also may be neuralgias (especially, sciatic, and dental), the tingling and numbness in the extremities, and disturbances of the special senses—hemeralopia, amaurosis, tinnitus. Increased reflex excitability of the nervous system is manifested by marked tendon reflexes, even ankle-clonus, and by visceral reflexes, vomiting, etc. Some of these phenomena may be explained by the new theories of toxemia. In the early months a tendency to sleep, especially after meals, is noticed, and some women use this symptom to diagnose the pregnancy. Some women suffer an exaggeration of their symptoms, and in them accesses of hysteria are more common. A partial fainting spell is a frequent complaint of pregnant women. It is accompanied by palpitation or fluttering of the heart, sometimes with pallor, and usually by slight loss of consciousness, resembling petit mal. Unless due to organic cardiac disease, the symptom, though annoying, is not dangerous.

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## CHAPTER V

### THE LENGTH OF PREGNANCY

WHILE it is important for many reasons to know the exact length of human gestation, we have to be satisfied with surmises and generalities. Ovulation may occur at any time. Authorities disagree as to the relation of the discharge of the ovum from the ovary to the time of menstruation. We do not know if an ovum is fertilizable when it leaves the Graafian follicle, or if it requires time, and if so, how much. We do not know how long it takes the spermatozoid to reach the ovum. Therefore it is impossible to determine the time of conception, as was shown on p. 26, even when the date of the fruitful coition is certain.

Furthermore, labor occurs often as the result of some trauma—a fright or any disturbance of the woman's ordinary course of life. Since the beginning and the end of pregnancy are indeterminable, of course we cannot estimate the exact length of the period. As a datum for the reckoning the menses are absolutely unreliable, since a woman may menstruate during the first months of pregnancy, in which case it would seem that she bore a fully developed infant after a short gestation, and, on the other hand, a woman may conceive during a period of amenorrhea, thus giving the impression that pregnancy was prolonged to ten or even eleven calendar months. This will explain those cases, referred to in most text-books, of pregnancy lasting three hundred and eighty to four hundred days. (See Parvin, *Obstetrics*, p. 210.)

The most reliable datum from which to estimate the beginning is the date of fruitful coition, and, reckoning from this day, pregnancy has been found to vary from two hundred and twenty to three hundred and thirty days, the average being two hundred and seventy days. In cows the average length of pregnancy is two hundred and eighty-five days, but a fully developed calf may be delivered any time from two hundred and forty-one to three hundred and twenty-one days after the cow was covered (Ahlfeld). From time immemorial women have reckoned two hundred and eighty days, ten lunar months, or nine calendar months, from the first day of the last period as the length of normal gestation, and for practical purposes this may be accepted, because in the majority of cases it holds true, but one must remember and admit the exceptions. (See p. 26.) No doubt some children require a longer time in the uterus for full development than others. Some seeds in favorable soil grow faster than others. The writer has delivered children that were carried eight months that were as fully matured as full-term infants, and also in one case, figuring as accurately as is ever possible, he delivered a child weighing three and one-half pounds which was fully three weeks over term.

The German law recognizes the legitimacy of a child born three hundred and two days after the death of the husband. In England a decision in favor of three hundred and seven days was made in 1917. In Austria the limits of legitimacy are two hundred and forty to three hundred and seven days; the French law, three hundred, and in America, while there is no legal limit, three hundred and seventeen days was judicially allowed (Schatz). The reader desiring authorities in medicolegal cases of this kind should consult v. Winckel (*loc. cit.*) and Peterson and Haines.

Without doubt pregnancy may be prolonged and an overgrown child delivered. Hannes found that in 50 per cent. of children weighing more than 4000 gm. (8½ pounds) the pregnancy had lasted more than two hundred and eighty days. Ciulla

and that in 1 case of 200 the pregnancy lasted more than three hundred and eighty days. Children that are carried over term may be larger in all dimensions, they may grow longer and harder (Bossi). The cranial bones ossify, the bi-rietal diameter increases, the body becomes firmer and less pliable; thus in both instances delivery is rendered difficult and more dangerous to mother and child. Children that are being carried over time not seldom die before labor. A careful autopsy performed in a case of this kind showed no pathologic changes except granular degeneration of the epithelium of the kidneys. In some instances labor pains come on at the computed term of pregnancy, but they subside and a period of three or four weeks elapses until actual delivery occurs. The author considers it inadvisable to allow a woman to continue far beyond the normal date of term, and, in the interest of both child and mother, induces labor in such cases. "Missed labor" is a term introduced by Oldham to describe cases where pains come when expected, but cease, the child dies, and is carried in the uterus a greater or shorter time, as, in one case, eleven months. A dead ovum carried in the uterus is a *missed pregnancy*. Various factors may influence the length of gestation, as the age of the woman, the sex of the child, etc. Young women are likely to have a shorter gestation; older women, longer. Women who have been sterile for years and old *miparæ* are likely to go over term. Women who had delayed puberty, *dysmenorrhæa*, who have long hard rigid cervixes, are also likely to have delayed labor. *Miparæ*, except old ones, not seldom fall into labor a few weeks before the date, the tense abdominal wall forcing the head into the pelvis against the cervix, which evokes pains. Subsequent children are carried longer, until the sixth or eighth month, when the uterus, because of lack of tonus or of pathologic changes, expels the product of conception as soon as it is ripe. Males are said to be carried longer than females. While this is true in animals, the author cannot confirm it from his own experience. Women who are active in the last months of pregnancy are less likely to go over term than the lazy ones, who take no exercise. One notices this in hospital practice. There is a popular notion that a gravida should exercise much during gestation or "the baby will be grown to her side," meaning that she will have a difficult labor from overgrowth of the infant. In summer women are likely to give birth earlier than in winter. Heredity seems to play a rôle. De la Motte reports a case of a woman who had two children at the seventh month. These girls grew up, married, and had children at seven months. Retzius describes an instance of a mother and her two daughters in all of whom pregnancy was much prolonged.

**Precocious and Late Pregnancy.**—The earliest authentic pregnancy is reported by Bodd. The girl was eight years and ten months old, and delivered a child weighing 3500 gm. (about 7½ pounds), which had hair on the pubis. Pregnancy in girls twelve to fifteen is not rare, and experience shows that most of the children live and that labor is not always difficult. The pelvis develops rapidly during pregnancy, and the child is usually small, with a soft head, which accounts for the unexpected safety of these precocious labors. The latest pregnancy on record is the one reported by Kennedy. The woman was sixty-two years old, and this was her twenty-second labor. The author delivered a woman of fifty-two years safely of a living infant weighing over seven pounds. In some of the cases reported (Strassman) menstruation had been absent for years.

#### LITERATURE

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## SECTION II

# PHYSIOLOGY OF LABOR

### CHAPTER VI

#### DEFINITION—CAUSES—CLINICAL COURSE

**Labor** is a function of the female organism by which the product of conception is expelled from the uterus through the vagina into the outside world, the regressive metamorphosis of the genitals started, and the secretion of milk inaugurated. There are three essential points in the definition, which excludes the extraction of the fetus by any other passage, as in cesarean section. Synonyms for labor are delivery, parturition, travail, childbirth, accouchement, confinement.

**Abortion** is the interruption of pregnancy before the fetus is viable, *i. e.*, capable of extra-uterine existence, which is after the twenty-sixth week.

**Premature labor** is the interruption of pregnancy after the fetus is viable, but before term, *i. e.*, the normal end of gestation.

**Miscarriage** is an expression used by the laity to signify the occurrence of a premature interruption of the pregnancy at any time.

Labor should be a normal function of the human female. It is so intricate, however, that a great many irregularities may mark its course. The unhygienic surroundings in which women live, prior diseases, the tendency to laziness, the evils of dress, of living, occupation, heredity, chronic endometritis, salpingitis, the evolution of the fetal head, *i. e.*, increased size of the child's cranium, due to the increased mental capacities of the race, all tend to produce conditions which influence the course of labor and may make it absolutely impossible in a given case, or fraught with great, even fatal, danger.

We, therefore, must divide cases into two groups:

1. Normal labor, or *eutocia*.
2. Abnormal (pathologic) labor, or *dystocia*.

As a matter of fact, a really normal labor without the slightest irregularity is rare; almost always there is some small point that is peculiar, although it may not affect the course of the labor, and the case may end favorably for mother and child. In general we call those cases normal where we do not have to interfere—where the woman expels the child and placenta herself, and she and the child live. Strictly speaking, however, unless the woman's condition is exactly as good as it was before conception and the child perfectly well and uninjured, the labor may not be called normal. Such cases as these are excessively rare. The boundaries between *eutocia* and *dystocia* are very narrow, and depend largely on the individual views of the obstetrician. Certain complications are classed by some under *eutocia*, while by others they are called distinctly pathologic. For example, I consider the vomiting of pregnancy, the kidney of pregnancy, breech and face presentation, rupture of the urogenital septum, to be pathologic conditions, while many authors hold them to be normal.

In the study of the phenomena of parturition four factors must be considered: (1) The *powers*, by which the expulsion of the ovum is accomplished; (2) the *passages*, which represent the road and the resistances met; (3) the *passengers*, the child

and its adnexæ (placenta, etc.); and (4) *external complications* which may disturb the course of the function. The last-named factor is the pathologic one, and will be omitted for the present. The other three factors make up the study of the mechanism of labor.

**The Causes of Labor.**—What brings on labor? Why should the uterus which has carried the ovum for so many months, suddenly violently expel it? Nature certainly recognizes the right moment for the expulsion, since it is almost always accomplished at a time when the child is best able to carry on extra-uterine existence, and before it has become too large to pass safely through the parturient canal. That the cause is that sets the uterus in action has been the subject of much speculation and investigation, but nature still hides the secret. We wish to know it, because often it is necessary to bring on labor ourselves, and experience has shown that it is wise to follow nature's methods in accomplishing things. The many theories can only be touched upon.

1. The ovum is prepared for separation by the degeneration of the decidua in the later months of pregnancy, and the disappearance of the placental septæ, thus loosening the attachment the latter to the uterine wall. The ovum, then, according to Simpson, Huvè, and Scanzoni, becomes a foreign body. The placenta does not loosen its living attachment to the uterine wall until the child is delivered, therefore this theory is untenable.

2. Thrombosis in the placental vessels causing increase of the carbon dioxide content of the uterine blood has been advanced by Leopold. The thrombosis is not constant, and it too must be explained, as it is pathologic.

3. Brown-Séquard proved that an increase of carbon dioxide in the blood will evoke uterine contractions. Lack of oxygen will do the same. The increased vascosity of the fetal blood, which normally occurs in the later months, due to the narrowing of the ductus Arantii and ductus Botalli, has also been suggested as provocative of uterine action—all not proved, but they indicate chemical as of study instead of mechanical.

4. Products of altered metabolic activity of the mother or from the child, accumulating in the maternal blood, may evoke the pains, either by way of the uterine innervation or indirectly through the vasomotor system. Schaeffer believes that the syncytium has an influence in limiting the passage of poisons from the fetus to the mother. Late in pregnancy the action of the syncytium is insufficient. Others have referred to the possibility of fetal poisons stimulating the uterine muscle. Williams found that just before labor there was diminished nitrogen output in the urine, and marked diuresis, confirming the suspicion that metabolic changes are involved in the causation of labor. It is possible that, by working this field, the active factor may be discovered. We know that diphtheria antitoxin sometimes brings on abortion.

5. Mauriceau believed that the excessive distention of the uterine wall resulted in labor. The uterine wall is not distended at term, therefore only in pathologic cases, as twins,—polyhydramnion,—could such a force act.

6. The increased irritability of the uterus is generally acknowledged to be an important factor. We know that the uterus contracts from the beginning of pregnancy, and also that the contractions become stronger and more easily elicited toward the end. This marked irritability due to the great increase in the development of the muscular fibers and the nerves and cells of the cervical ganglion. When the end of pregnancy is near, some slight accident may make the contractions stronger, and each contraction stimulates the succeeding one until regularity is established.

7. The influence of the periodicity of menstruation cannot be denied, though why the final sort of the uterus should come at the completion of the ten menstrual cycles is not understood. It is not believed that the ovaries have anything to do with it, since labor can occur without them. The same is true of the corpus luteum, though Born and Fränkel have sought to connect the two. In some women, particularly those of a nervous type, there occur, during pregnancy, at the time of the usual menses, peculiar sensations and manifestations which show that some influences are at work. Neuralgic pains, especially in the sacrolumbar region, insomnia, skin eruptions, increase of the varicosities, vomiting, nausea, diarrhea, constipation, decreased urine, sometimes albumin, uric pain, sometimes small hemorrhages, and the tendency to abort are greater at these periods. De Paoli studied these changes in 30 women, and found diminished lung capacity; lower blood pressure; increased sensibility of the skin and of the reflexes; more rapid pulse. Pathologic conditions are more common at these periods—for instance, eclampsia, fainting, hysteria, pains in the bones.

8. Pressure of the presenting part on the lower uterine segment on the cervix and the nerves of the great cervical and retrocervical ganglia, and other plexuses around the cervix and upper vagina, is an old (Galen, Power) and favorite theory, but it will not explain all cases, such as breech and transverse presentation and the uterine contractions of extra-uterine pregnancy. In some cases the head may be deep in the pelvis, and pressing hard on the cervix, without evoking pains. Still, clinical experience shows that when the child settles well into the lower uterine segment the dilatation of the cervix begins, and labor comes on. The methods employed in inducing labor nearly all operate by irritations applied to the nerves of this region, *e. g.*, the packing of the cervix with iodoform, the application of colpeurynters, bougies, etc. One can often bring on labor by passing the finger around the internal os and stretching it a little.

These are the principal theories, of which the most plausible are pressure of the presenting part on the ganglia and nerves of the lower uterus and cervix, the increased irritability of the uterus, and changes in the blood of the mother, fetal in origin.

9. The importance of accident, however, must not be overlooked. When everything is ready for labor, the parts softened, the cervix begun to unfold, the uterine muscle well developed and having attained a high degree of irritability, it is easy to see how some slight cause, mechanical or emotional, may suddenly start the uterine contractions. As soon as one contraction has occurred it seems to form the irritant for another, or forces the ovum against the cervix, stimulating the nerves, so abundant here, and thus labor is put in progress. Such exciting causes are physical shocks,—jolts, running up or down stairs, coitus, diarrhea, straining at stool—mental shocks,—sudden fright or joy,—of which there are numerous illustrious examples. The Bible tells us that the wife of Phineas, upon hearing that her husband was killed in battle, went into labor. A patient of the author's, feeling that her labor was due, walked down and up the six flights of stairs to her hotel apartment. Pains came on within a few hours. She had a slight hemorrhage behind the placenta. A dose of castor oil or quinin will often bring on labor at term.

Most recently, the onset of labor has been ascribed to an anaphylactic process. In 1905 I began a series of experiments, seeking to prove that ferments circulating in the blood of parturient horses could invoke labor in pregnant guinea-pigs, but was unable to prosecute the research to the end. The action of other hormones in affecting distant organs is proved, and it is possible that serology will finally clear up the mystery. The action of pituitrin must be borne in mind. Possibly it sensitizes the uterus so that any external stimulant can start uterine action. Experiments by Sauerbruch and von der Heide with rats show that substances appear in the blood in the later weeks of pregnancy which cause disease in non-pregnant animals. Von der Heide injected fetal blood-serum into pregnant women at term and evoked labor pains. He explained the reaction as anaphylactic. Kolmer could not confirm this. There seems to be some serologic relation between the mammae and the uterus (Healy and Kastle), and Koehler found that other organ extracts act the same way, *e. g.*, the spleen, testicle, ovary, hypophysis, thymus.

### THE CLINICAL COURSE OF LABOR

It will be simpler to study the complicated problems of labor if, first, we get a clear picture of its clinical course; that is, what may be seen and felt while attending a woman in parturition.

In most primiparæ and many multiparæ there is a prodromal stage of labor, but in both the symptoms may be so slight that they may be unnoticed, and labor, therefore, seems to come suddenly. The prodromata are: (1) Lightening, with its symptoms, relief of pressure in the upper belly, and increase of pressure in the pelvis, together with a mucous discharge from the vagina. (2) False pains; in the latter weeks of pregnancy the patient is often annoyed by contractions of the uterus which are painful. They occur especially at night, subsiding toward morning. The uterus contracts at intervals throughout pregnancy, and shows greater irritability near the end. This sign is of value in determining that labor is at hand. Ordinarily, the contractions are not painful until actual labor sets in. False pains may be simulated by gas in the bowels, constipation, and appendiceal or gall-stone colic. Many women complain of drawing sensations in the pelvis similar to those experienced during menstruation, sometimes amounting to pain; these are called *dolores præsentantes*, and often accomplish effacement and dilatation of the cervix. (3) About twenty-four or forty-eight hours before labor there is a discharge of mucus, often mixed with blood. It is the plug which formerly filled the cervix, closing off the uterine cavity from the vagina. The blood comes from the surface left bare by the separation of the decidua. It is more or less profuse, is important, and is called the "show." If the placenta is situated low in the uterus, the show is likely to be quite bloody. Occasionally the show does not appear until labor has been in progress some time. (4) An examination in the last three weeks of pregnancy shows the cervix soft, shortened, perhaps completely effaced—in primiparæ the external os opened for one or perhaps two fingers. In multiparæ the cervix will admit two fingers to the membranes. Exceptionally, the

ternal os, as well as the internal, remains tightly closed until labor begins, but if it is abnormal, and is usually due to cervical disease. Occasionally the os is dilated to admit three or four fingers—the result of the “travail insensible” of the menarche. However, it is unsafe to predict with certainty the near approach of labor from the patulousness of the cervix, though it is quite probable. (5) The vulva is enlarged, succulent, and patulous, the pelvic floor projection very decided.

The painless contractions of the last weeks of pregnancy, the “insensible labor,” force the head down into the pelvis and soften the structures—the lower pole of the uterus seems to slowly burrow its way into the pelvic excavation.

The transition into labor is usually very gradual, but we say that labor has begun when the contractions of the uterus become sensible to the patient—that is, painful; when they recur at regular intervals, and when they are effective in dilating the cervix and os.

The process of parturition naturally divides itself into three stages or periods:

The first stage extends from the beginning of regular uterine contractions until the os is completely dilated and flush with the vagina, thus completing the continuous channel called the “parturient canal.” This is the stage or period of dilatation. The membranes usually rupture at the end of this stage—perhaps during it. The



FIG. 136.—COMPOSITE PICTURE SHOWING THE UTERUS BEFORE AND DURING CONTRACTION.

second stage does not include the rupture of the bag of waters, the time of which is very variable.

The second stage extends from the end of the first stage until the expulsion of the fetus is completed. It is the stage of expulsion.

The third stage extends from the delivery of the child until after the expulsion of the placenta and membranes and contraction and retraction of the uterus are completed. It is the period of the after-birth, or the placental stage.

In the first stage, recurring regularly about fifteen minutes apart, we notice the uterine contractions. These are appreciated by the patient as pain, and have been, therefore, designated by the various races from time immemorial as “pains,” “dolores,” “douleurs,” “Wehen.” No normal labor is painless, though quite a few such have been observed. Writers of all ages have described labor as painful.

The Bible mentions it in numerous places. Accounts of uncivilized races disprove the claim made by some that with them child-bearing is painless. (See Ploss, "Das Weib in der Natur und Völkerkunde"; Engelman, "Labor Among Primitive Peoples.")

Still, the severity of the pain varies. Some races, especially the uncivilized, have generally easy labors, whereas the highly cultured woman has hard, painful labors. This is true to a certain extent, in our civilized country, in the difference between the poor and the rich. The pain varies in different women, and the ability to stand pain varies in women, as it does in men.

As the labor progresses the pains gradually grow stronger. Whereas at first the patient just bends over a little, shows a change of countenance, after a few hours she may utter a cry. The cry is simply one of pain, similar to that of a severe toothache or intestinal colic. One observes much individual difference in women regarding the pain of labor. Those of quiet, even temperament and strong will-power

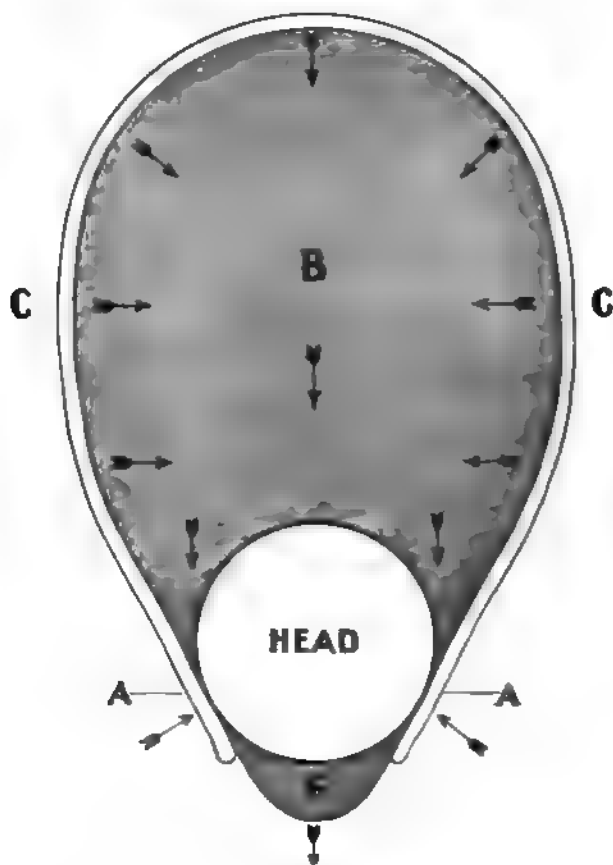


FIG. 137.—BALL-VALVE ACTION OF HEAD.  
Head at A-A divides uterus into two cavities. Pressure in C is much less than in B.

bear their sufferings bravely and aid the physician and nurse, while the nervous, hysteric parturient cries out even early in the first stage, demanding an anesthetic or even delivery, and not seldom gives an otherwise normal labor a pathologic trend. The very first pains are usually felt in the small of the back, but soon they draw around to the front and are described as grinding, or like a severe general intestinal colic. They often seem to come in pairs—a mild one followed by a severe one. They last thirty to ninety seconds or longer. The character of the pain varies in different women, different labors, and different times of one labor. They may subside and recommence after hours or days (rare). The patient is cheerful between

s or may dose. As the pains grow stronger the intervals become shorter—ten, five, four minutes. During the pain one observes the uterus contract. This ends before the pain is felt, and ends after the painfulness is over (Fig. 136). The uterus rises high in the abdomen, increases in diameter anteriorly and posteriorly, decreases laterally, assuming a pear shape. At the same time it becomes harder, tense, and the ligaments stand out sharply. There is a stage of accretment, e, and decrement in each pain.

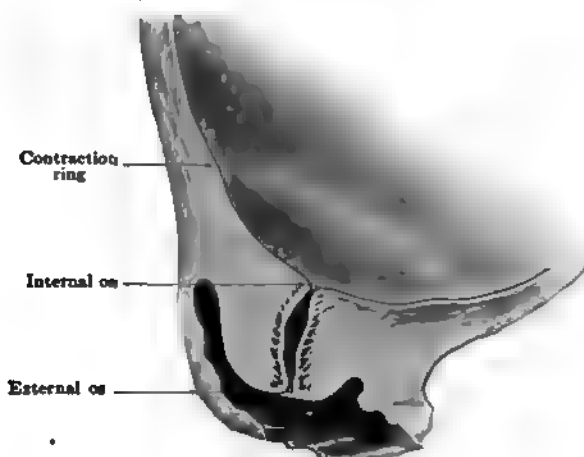


FIG. 138.—CERVIX AT BEGINNING OF LABOR, SHOWING THREE SUCCESSIVE STAGES OF EFFACEMENT IN A PRIMIPARA.

Under the influence of the uterine contractions—

1. A larger amount of the serum is forced into the lower uterine segment, cervix, and upper vagina.
2. The fibers of the lower uterine segment and cervix are drawn up into the body of the organ.

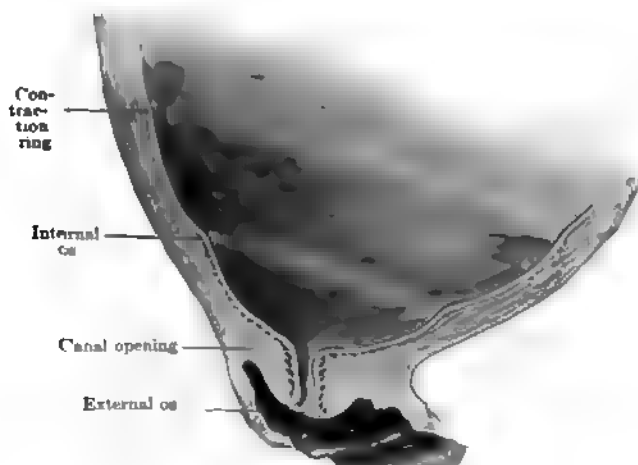


FIG. 139.—SAME AS FIG. 138.  
Effacement half completed.

3. The liquor amnii is forced in the direction of the internal os.
4. The membranes are bulged out through the cervix.
5. The retraction of the fibers of the lower uterine segment and cervix, and the membranes being forced down into the cervix like a bladder, cause a dilatation of



the cervix from above downward, and finally the full opening of the external os. This dilatation of the cervix by the bag of waters is a very gentle and efficient one. The whole force of the uterus is not used, since the head resting against the lower uterine segment divides the cavity into two parts (Fig. 137). The resistance at A-A diminishes the power of C-C, therefore the tension in G is not so great as in B. Should the body not press fast to A-A, allowing the fluid in B to communicate with the fluid in G, the tension in G would equal that of the space of B. This occurs often clinically. During a pain the tension in B rises; therefore also of G, but to a less degree; when the pain passes away the tension in both subsides. Thus it is seen how the head acts as a ball-valve, and becomes, with the membranes, the gentlest possible method to efface and dilate the cervix. Compare this to the rough dilatation which would occur were there no bag of waters, and if the head were driven through the cervix by uterine and abdominal forces. This happens when the bag of waters ruptures before labor, especially in primiparæ. These are called "dry labors," and are usually long, tedious, and painful. Operative interference is oftener necessary in dry labors.

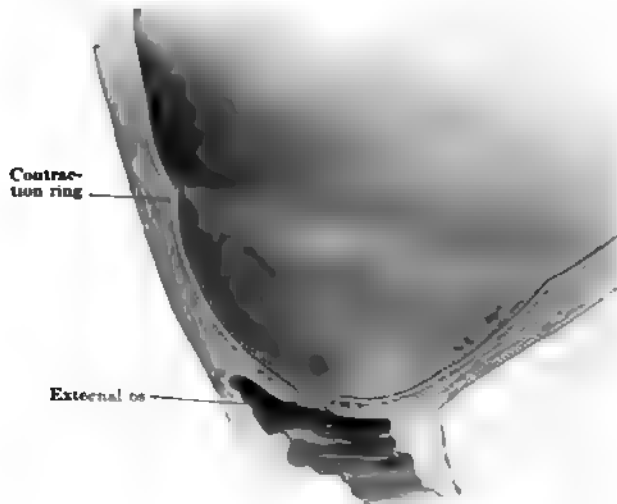


FIG. 140.—SAME as FIG. 138.  
Effacement complete Dilatation just beginning.

We have used two terms which need explanation—effacement and dilatation of the cervix. At the beginning of labor the cervix is shaped as in Fig. 138.

By the action of the uterus, which we will later study more minutely, the muscle-fibers are drawn up into the uterine body, the membranes are forced, pouch like, into the cervical canal, the two processes resulting in a dilatation of the cervix from above downward. The cervix is "taken up," it is "obliterated," it is "shortened," it is "effaced." The latter term is the one preferred by the author. When the cervix is so far taken up that only the external os remains, we say that effacement is complete. Dilatation now begins (Fig. 143). When the external os is opened so wide that it is flush, or nearly so, with the vagina, dilatation is complete, and the child is now able to pass through it (Fig. 144). Coincident with the dilatation the cervix is drawn up into the abdomen, so that, when the dilatation is complete, the external os is high—almost out of the reach of the finger. The bag of waters usually ruptures at this point.

The comparison of the parturient passage to two funnels, one placed above the other, is quite apt. The child has to pass first through the upper, the cervix, and, second, through the lower, the pelvic floor. Effacement of the cervix and dila-

tation occasionally occur simultaneously, especially in multiparæ (Figs. 141 and 142). When the cervix is fully opened, the first stage of labor is ended, and the second stage begins.

**The Bag of Waters.**—Baudelocque defined the bag of waters as that portion of the membranes which pouched into the cervix during the uterine contraction. Later writers gave the name to that portion of the membranes which was uncovered by the dilating os. Others call the whole amniotic sac the bag of waters. The

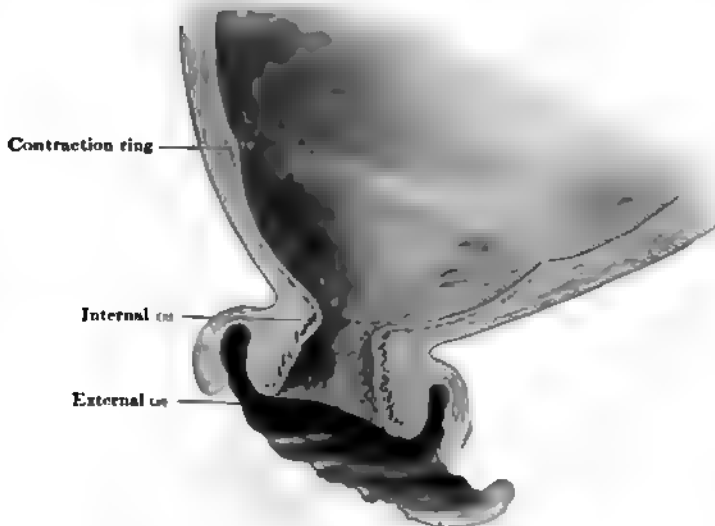


Fig. 141.

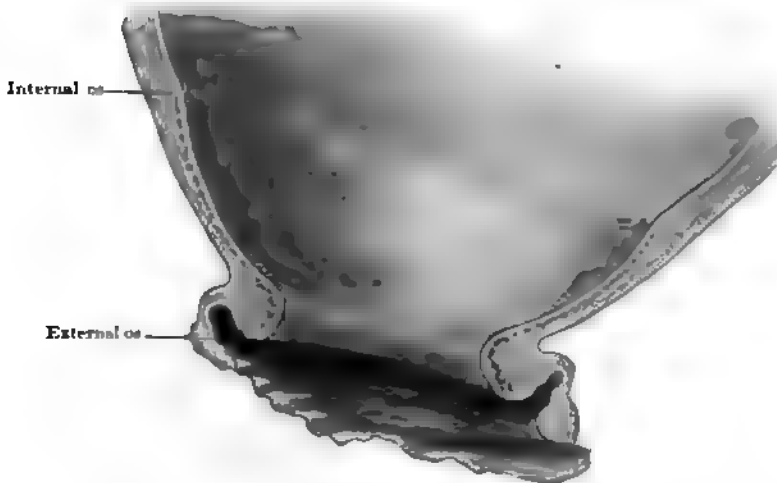


Fig. 142.

FIGS. 141 AND 142.—TWO STAGES OF THE COMBINED EFFACEMENT AND DILATATION OF A MULTIPAROUS CERVIX.

author prefers the latter view, though when speaking of the bag of waters the part presenting over the os is the part usually referred to. At the beginning of labor the membranes point into the cervix like a flat cone. As the dilatation progresses the bag of waters assumes the shape and appearance of a large watch-crystal, projecting through the os (Fig. 146). If the membranes are soft and exposed to the whole pressure in the uterus, they bulge out into the vagina or may rupture early. If the

chorion ruptures, the amnion may project through the partly dilated os like a sac (Fig. 148). If the head fits closely onto the lower uterine segment and the membranes are firmly adherent, no bag of waters forms, and labor is usually delayed in such cases (Fig. 149).

The best time for the membranes to rupture is when the cervix is completely effaced and dilated, but they may break at any stage, even before the pains begin, (dry labor). If the chorion ruptures alone, the amnion may be pushed out, covering the head of the advancing child, and may be delivered with the latter. The child is said to be born with a "caul" and to be lucky. The caul must be removed as soon as the head is born, to allow the infant to breathe.

The rupture of the bag of waters usually takes place at the height of a strong pain, and is oftenest central, the waters coming with a gush. Or the rupture may take place high up, and the waters dribble away at each pain. Sometimes an ac-

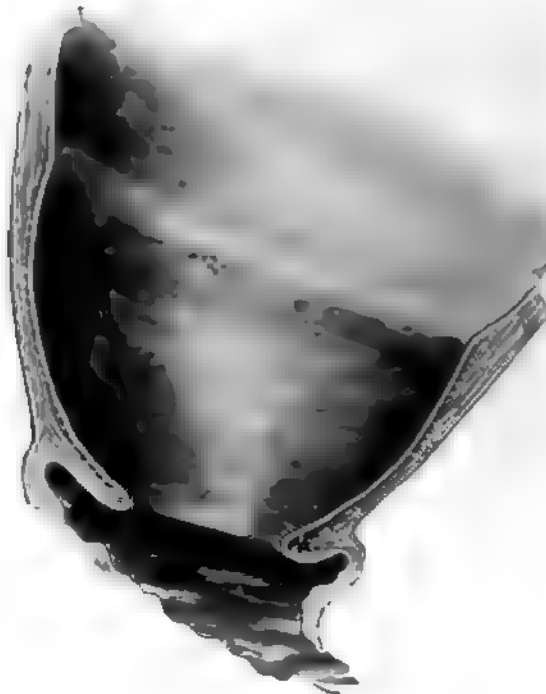


FIG. 143.—EFFACEMENT IS COMPLETE, DILATATION IS GOING ON.

cumulation of fluid between the two membranes occurs, and the chorion ruptures while the amnion remains intact. Thus there seem to be two bags of water.

After the rupture of the bag of waters there is generally a short pause in the pains. The uterus needs time to accommodate itself to the diminished size of its cavity and for the retraction of its muscular lamellæ. A few drops of blood may now appear, coming from decidual separation.

Coincidentally with these changes in the cervix the fetal body has descended lower into the pelvis, the bag of waters or the head distends the vagina and may reach the pelvic floor. It presses on the nerves of the rectum and outlet of the pelvis, and the parturient feels like bearing down as if at stool.

**The Second Stage Has Begun.**—The pains grow stronger, more frequent,—every three or two minutes,—and are changed in character, being expulsive. The patient utters a peculiar cry. She feels there is a body in the pelvis which she must force out; she closes the glottis, having fixed the chest in inspiration, braces the

against the bed, and, by a powerful action of the abdominal muscles, drives the  
downward against the perineum. During the contraction the uterus becomes

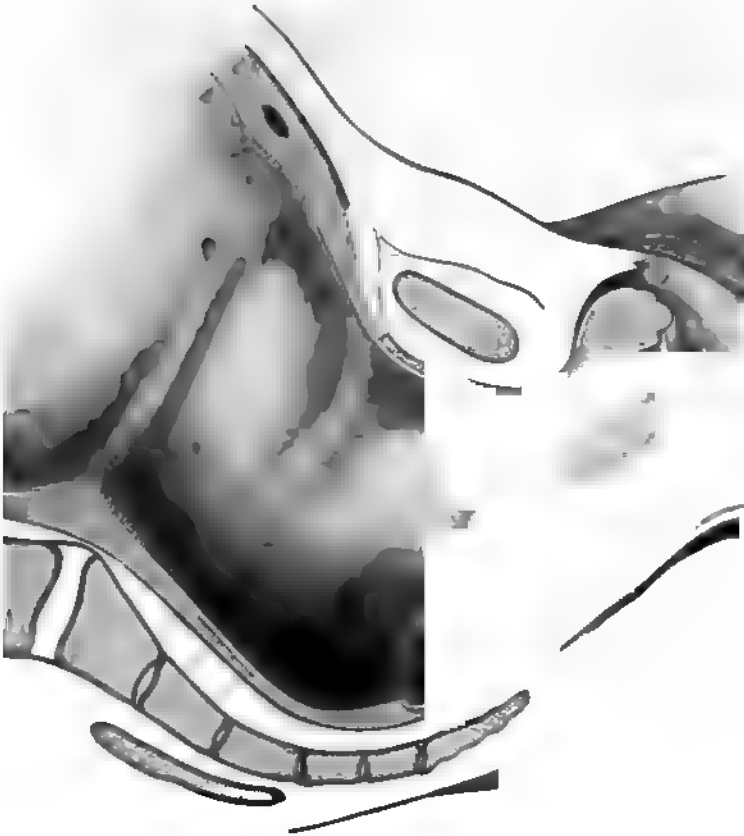


FIG. 144.—BOTH EFFACEMENT AND DILATATION ARE COMPLETE.

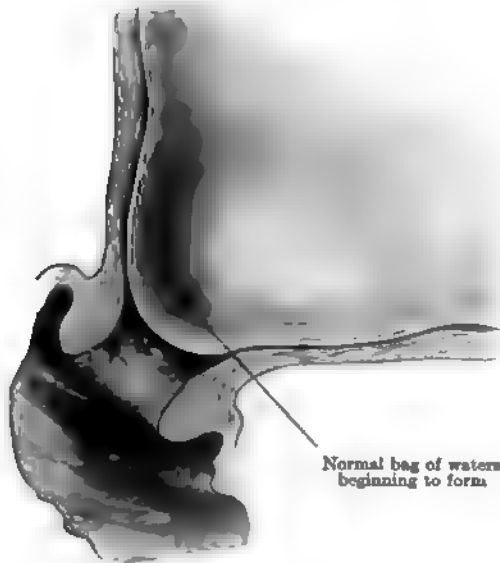


FIG. 145.

board-like in hardness. The parturient is working hard—indeed, the process is rightly called labor. Her pulse is high, the veins of the neck stand out, the thyroid is swollen, a fact which Aëtius in 1567 said caused goiter, the face is turgid, the body bathed in sweat.

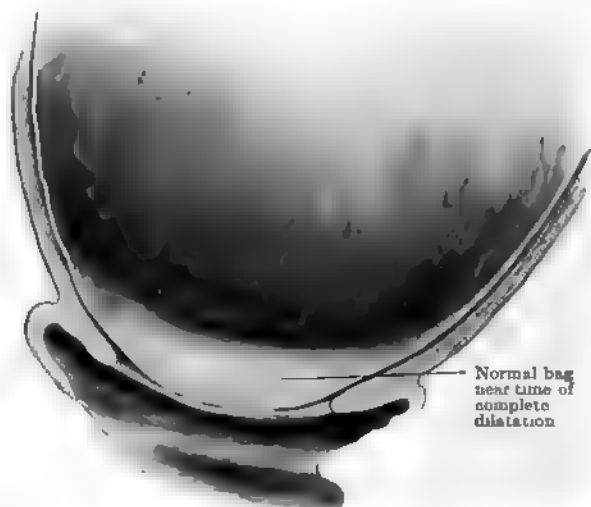


FIG. 146.

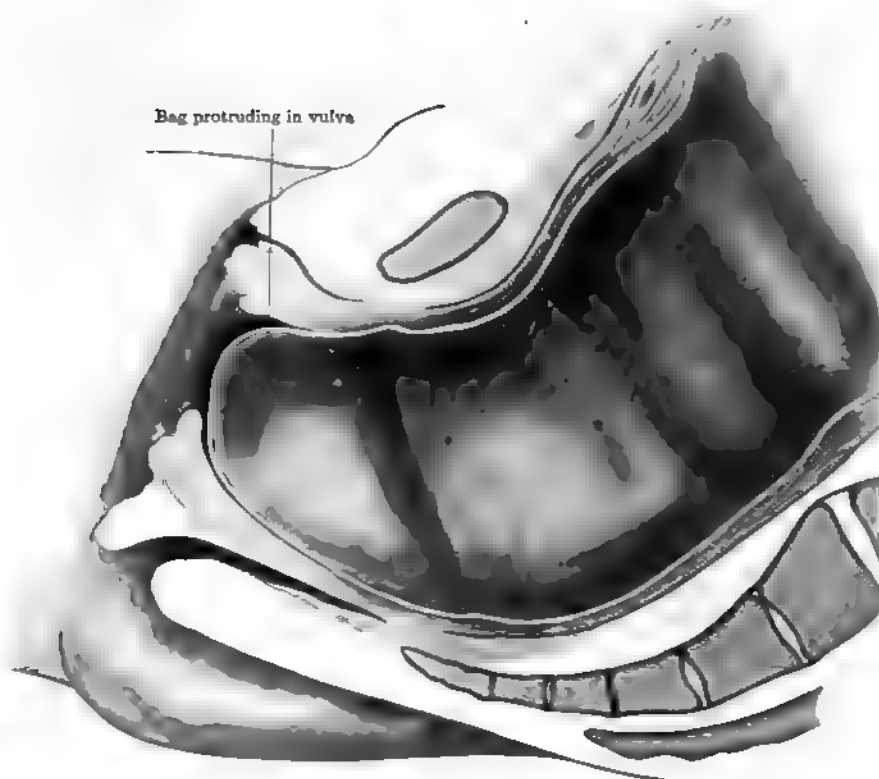


FIG. 147.

Owing to the pressure of the head on the sacral and obturator nerves as they go out of the pelvis, the patient complains of pains radiating into the legs and to the

In general the patient is more hopeful, since she can help and feels that there is progress in the labor, whereas in the first stage all she had to do was to bear the pain. The perineum soon begins to flatten out and soften. The glands pour out a



FIG. 148.

Figs. 145, 146, 147, and 148 represent the different shaped bags of waters.



—BAG FITS FETAL HEAD LIKE A CAP. DOES NOT AID DILATATION, AND OFTEN OBSTRUCTS LABOR.

n is due to the head itself pressing on the rectum. After thirty to forty the anus begins to open, and, if the woman has hemorrhoids, these swell up o bursting. Soon the labia part during the height of a pain, allowing the l scalp to show. As the pain subsides the elastic pelvic floor forces the head With the next pain the perineum bulges more, the anus opens wider, so that see its anterior wall, the labia part further, and a larger segment of the comes visible. As the pain disappears the head recedes. In the interval pains the woman lies back exhausted, or may have a few moments' re-sleep. When the resistance of the pelvic floor has been thus gradually e, the head comes to rest in the rima vulvæ, the nape of the neck stemming ie pubis. Now, by a crowning effort, under great nervous exaltation and l abdominal action, the head is forced out, the occiput coming from behind s, the forehead, face, and chin rolling over the perineum. The woman feels



FIG. 152.—EXTERNAL RESTITUTION.  
A retouched photograph.

is being torn asunder. After this there is a pause of a few minutes, when s are renewed, the shoulders are delivered, and then generally the trunk, ng, hard, expulsive effort. The child gasps, lying between the thighs of aer, and soon cries vigorously. A little blood and the rest of the liquor amnii ends of the membrane are now discharged. The uterus contracts down into The patient feels much relieved. She may have a chill now, but this is ed physiologic. It may occur after the placenta is expelled and is not con- The cause of this chill has been much discussed. The author has seen fewer r chills with the perfection of the aseptic technic of labor, and is inclined to hey are due to absorption of toxins from the parturient canal if not anaphy- Abdominally, one finds the uterus contracted to a ball the size of a cocoanut. as the work of delivering the placenta. The second stage is ended. The n severs the cord, separating the child from the placenta, and this act es the legal status of the child as an individual.

**The Third or Placental Stage.**—After from five to twenty minutes, devoted to rearrangement of its muscular lamellæ, the uterus begins to contract again. Some blood usually appears externally with the first pain. The uterus at first is somewhat relaxed, slightly flattened, but during a pain it becomes smaller, harder, and globular. The after-pains are usually not very painful: often the patient perceives only a slight drawing sensation, but the accoucheur can feel the regular (four to five minutes' contractions. After a period varying from a few minutes to an hour or more the fundus uteri rises high in the abdomen, generally under the liver, while



FIG. 153.—UTERUS RISES IN ABDOMEN TOWARD LIVER. PLACENTA MAKES A SOFT ENLARGEMENT ABOVE PUBIS.  
Drawing by A. J. C. G. G. G.

below, over the pubis, the abdomen feels soft and boggy (Fig. 153). At the same time the cord advances a few inches from the vulva. These signs indicate that the placenta has loosened from the uterine wall and has descended into the lower uterine segment and upper part of the vagina. When the placenta is in the uterus, the organ is large and globular. When the placenta has been forced from its bed into the lower uterine segment and upper vagina, the uterus assumes a flattened pear shape. The flattening is from before backward and the fundus is sharp. On the anterior or posterior surface often a broad, shallow dimple is to be felt—the site of the placenta. The sharp fundus and the flat dimple are other evidences that the



has left the uterine cavity. After a few contractions the uterus again becomes globular. If blood accumulates in the uterus it also becomes globular. After a period, if the patient is let alone, varying from fifteen minutes to three hours, the placenta is spontaneously expelled by the combined efforts of the abdominal muscles and the uterus. Generally, the attendant does not wait for spontaneous delivery, but completes the process himself. The placenta is usually introduced under an umbrella, and draws the membranes after it, peeling them off the wall (Schultze's method). Sometimes the placenta slides out without disturbance, the lower portion appearing first (Duncan's method). With the after-



FIG. 154.—EXPRESSING PLACENTA.  
A retouched photograph.

a small or greater quantity of blood is discharged. Now the uterus contracts and forms a hard lump in the inlet of the pelvis, extending to the navel. It is of the size of a fetal head. (See page 204.)

The third stage is ended. The *puerperium* has begun. The parturient has become a *puerpera*.

#### THE PAINS

The uterine contractions, the most prominent symptom of labor, deserve more attention.

They are involuntary. The woman has no control over them, but they are under the domain of the cerebrospinal system. A mental shock may augment or

paralyse the uterine action. For instance, the abrupt entrance of a stranger may "drive the pains away." In one case of exceedingly slow labor the author expressed his intention to insert a colpeurynter. Strong pains came on at once and delivery was affected within an hour. It is known that fear produces an increase of epinephrin in the blood. Could it also flood the circulation with hypophyseal hormone and thus stimulate the uterus?

2. The action of the uterus is not peristaltic to the degree that exists in animals. The uterus may contract in one portion, the hardening extending quickly all over. This the author has repeatedly observed after delivery of the child in cesarean sections. Portions of the uterus may contract while the rest remains in a state of retraction—for instance, "hour-glass" contraction; cornual contraction.

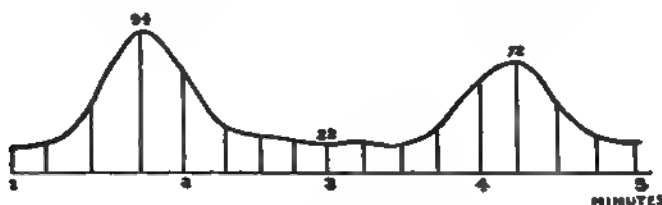


FIG. 155.—SCHATZ'S PAIN TRACING IN THE FIRST STAGE.

3. The action of the uterus is intermittent—that is, the pains recur at intervals. This intermittence aids the circulation in the parts. During uterine systole the blood in the veins is forced toward the broad ligaments; during diastole the uterus becomes turgid—to be observed at cesarean sections. Pelvic congestion is thus produced, and the resulting succulence of the cervix and vagina is a strong factor in their dilatation. By coördinated action the arteries dilate and more blood is brought to the uterus (Werth). The blood in the uterine sinuses would be stagnant were it not for these intermittent uterine contractions, which much resemble the action of a local heart. The fetus is thus provided with sufficient oxygen. In cases of

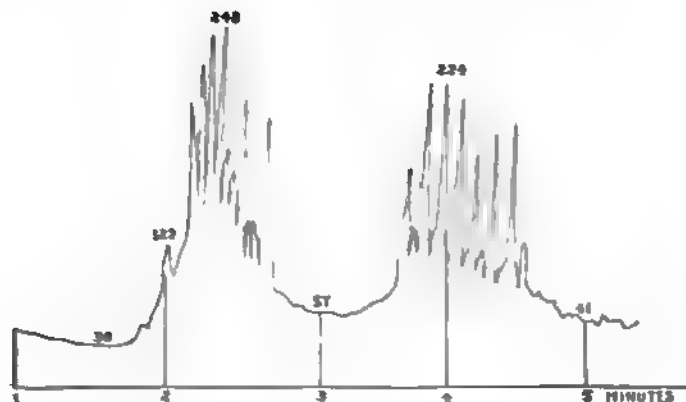


FIG. 156.—SCHATZ'S PAIN TRACING IN THE SECOND STAGE.

tetanus uteri the child may die of asphyxia because the hard, contracted uterus will not allow enough blood to flow through it.

The intermittence provides for the necessary rest of the muscle, the removal of waste, and the proper application of uterine force to the mechanical object of labor. The uterine action is a beautiful example of applied power.

4. The contractions are rhythmic, having three phases—increment, acme, and decrement. The increment is longer than the acme and decrement (Figs. 155 and

156). Schatz placed rubber bags in the functioning uterus and registered the pressure variations with a manometer, calling the apparatus a "tokodynamometer." His work is classic. The pain lasts from sixty to ninety seconds, the intervals from a few seconds to an hour, depending on the stage of labor and individual characteristics. Some pains are double. Sometimes a weak pain precedes a strong one. The first-stage pain differs from that of the second stage. The addition of the abdominal pressure alters the character of the curve. (Compare Figs. 155 and 156.)

The contraction is well under way before the patient feels the pain, and continues a short time after the pain is gone. The pains grow stronger with the increased frequency. The educated hand laid on the abdomen can discover nearly all these points.

5. The uterine contractions are painful. No other bodily function involving contraction of unstriated muscle is painful, and why these should be is incomprehensible if labor is to be considered a normal function.

Before labor has actively begun the pains are called *dolores præagientes*. When the os is beginning to dilate, they become quite painful, and are called *dolores præparantes*. They seem to have their seat in different places—sometimes in the back, in the pelvis, again in the abdomen.

The first pains of labor are felt in the back, near the kidneys, and are called by the French women "pains of the kidneys." They may be felt only as a sensation of weakness, and the patient supports her back. Later the pains are felt more in the pelvis. In the first stage the pain is due to the pressure of the presenting part on the nerves of the cervix, to the stretching of the same during the dilatation of the os by the presenting part (Madame Boivin, who had personal experience), or to the compression of the nerves in the wall of the uterus. Perhaps all three causes are combined. The pains are described by the women as grinding, twisting, or resembling severe abdominal colic.

The pain in the small of the back is due to radiation, such as is common in pelvic neuralgias. The nerves involved are the sacral and lumbar plexuses. The pain caused by the dilatation of the last fibers of the cervix is particularly acute, and sometimes a slight amount of blood may show itself, indicating a tear in the external os.

When the head passes down into the vagina and begins to press on the perineum, the pains are due to the stretching of these parts and are spoken of as tearing.

The patient now bears down and the pain cry is altered. She does not complain so much, but helps the labor along by pressing down with the abdominal muscles. When the head goes through the vulva, the greatest anguish is felt, the patient feeling as if she were torn open (*dolores conquassantes*). The pain may be so great that the patient faints or is temporarily insane, but both are rare.

These pains are called *dolores ad partum*. After the birth of the child the uterine contractions are called after-birth-pains, or *dolores ad secundum partum*. They usually are not so severe as the others, but in some patients they are very painful.

After delivery the pains are called *dolores post partum*, or "after-pains," and, especially in multiparæ, disturb the first days of the puerperium, often requiring treatment.

Painless labors do occur, but are very rare. If not due to disease of the spinal cord, it is hard to explain them. The women feel simply the desire to strain, as at stool, and delivery is usually quick. "Christian Scientists" claim to have no pain, but I have often observed they present positive evidences of suffering, reminding one of the stoical martyrs in Rome.

## CHAPTER VII

### THE EFFECTS OF LABOR ON THE MATERNAL ORGANISM

It is not to be expected that a process requiring so much muscular exercise, such anxiety, and accompanied by such pain and traumatism, can be without a strong influence on the maternal organism. The patient eats little, sometimes vomits, is usually restless, and does not sleep much during labor. She may even have had pain at nights and very little sleep for a week, both of which exhaust her. A labor lasting a few days leaves the patient weak and completely tired out, but this depends on the length of the labor and the strength of the woman in the first place.

**The Duration of Labor.**—The length of parturition is variable, which is true also of the same woman in different labors. In the uncivilized races labor is somewhat shorter. It is said that some Indian women, while the tribe is on the march, feeling the pains of labor coming on, go off to the side in the underbrush, bear the child, and, after expressing the after-birth, hurry to catch up with the rest of the train, but this is exceptional, and later writers tell us that obstetric disease and mortality are large among the uncivilized races.

In primiparæ labors are longer than in multiparæ; labor is shorter in warm climates, also during summer; in poor, hard-working women than in the rich and pampered; therefore shorter in the country than in the city.

The size of the fetus has a great deal to do with it—a large fetus, long labor. The same holds true if the fetal head is large and hard, and in contracted pelvis. In young, strong primiparæ labor is easier than in old primiparæ, the average in the latter being twenty-seven hours, but one is often surprised to see an easy labor in a primiparous patient over forty years old. Labor is longer in fat women, longer with boys than with girls, because they are larger. The lengths of the various stages of labor are about as follows: Primiparæ, first stage, sixteen hours; second stage, one and three-quarter to three hours; third stage, from a few minutes to several hours. Multiparæ, first stage, twelve hours; second stage, one-quarter to one-half hour; third stage, from a few minutes to several hours.

Extremes are not rare. We have had cases where labor was completed in even less than one hour. Again, there are labors which are slow from the start, requiring days for completion. Labor may intermit, an interval of hours or days occurring after the pains have begun and dilatation of the os has been effected. The difference in the length of labor in primiparæ and multiparæ is due to the slowness of dilatation of the cervix, perineum, and vulvar orifice in the former. In multiparæ, owing to stretching and tearing by previous deliveries, the resistances offered by the soft parts are less and much more readily overcome. If many years elapse between deliveries, some of the original resistance may have been regained.

In 1000 labors at the Chicago Lying-in Hospital the pains began as follows:

#### HOURS OF BEGINNING LABOR

Between 6 p. m. and midnight	274
“ midnight and 6 a. m.	306
“ 6 a. m. and noon	238
“ noon and 6 p. m.	182
	<hr/>
	1000

## HOURS OF DELIVERY

Between 6 P. M. and midnight . . . . .	229
“ midnight and 6 A. M. . . . .	278
“ 6 A. M. and noon . . . . .	267
“ noon and 6 P. M. . . . .	226
	<hr/> 1000

**The Temperature.**—The muscular exertion during labor would raise the temperature if the loss of heat were not so great. Perspiration is increased, exposure of the body greater, respiration faster—all tend to keep the woman's temperature normal. Accurate takings have shown, however, that there is a slight rise during labor, which is greatest right after delivery of the child, and varies with the usual daily variations, but does not normally exceed 1° F. During the pain the temperature rises a little. The temperature is likely to rise during a prolonged second stage. Overstrain and sleeplessness conduce to it (Adami). The author is convinced that very few of more than one degree during labor is toxemic or septic in origin, and comes from the absorption of toxins or bacteria from the puerperal wounds. H. Müller came to the same conclusion. With the perfection of an aseptic technic slight fevers during labor are very rare, and the postpartum, so-called “physiologic,” chill has become almost unknown. The chill formerly was ascribed to exhaustion of the mother, prolonged exposure of her person, loss of a source of heat, the child, readjustment of the abdominal circulatory conditions, nervousness, etc., but the author believes that the chill, too, is due to infection during labor. Proof of this is hard to bring, but if the other causes mentioned were real, the chill ought to follow nearly every labor, whereas statistics show that it occurs in only 20 to 30 per cent. In the author's practice it has almost disappeared with the perfection of asepsis, the use of rubber gloves, and the restriction of the internal examinations. If not due to infection, the possibility that it might be of an anaphylactic nature is to be considered, but even this may also result from bacterial action.

**The Circulation.**—The rate of the heart-beat increases somewhat during labor, reaching 100 or 110, but between the pains may be normal. The advent of a pain is heralded by a faster heart-beat. In the second stage, during the severe muscular exertion, the pulse-rate increases a good deal, but in the third stage, if no hemorrhage be present, it is usually normal. Any marked rapidity must put you on your guard against hemorrhage, external or internal. Arterial tension is increased until after the third stage unless there is hemorrhage or chloroform narcosis. During the pain the arterial tension is greater than in the intervals, 5 to 10 mm., and a moderately heightened blood-pressure continues a few days into the puerperium. The educated finger can determine these points, but the sphygmomanometer proves them scientifically (Slemons, Faught). In order to make a firm support of the action of the abdominal muscles in the second stage, the parturient fixes the head in inspiration and holds her breath. If the bearing-down efforts are very hard and prolonged, the pulmonary circulation is interfered with, the right heart is congested, the blood cannot get into the chest, there is marked turgidity of the veins of the neck and head, and from this there sometimes result enlargement of the thyroid, which disappears postpartum, edema of the face, even tiny hemorrhages in the conjunctivæ. These evidences of venous congestion are, in bad cases, found also in the brain (Hodge).

The **respirations** are increased during the pains, but between pains are normal. Some nervous women hold the breath during the pains, even in the first stage. In the second stage breathing is more rapid, irregular, and altered by the bearing-down efforts and cries of pain. In the third stage they are again normal, unless there be hemorrhage, when an increase in number, or gasping, shortness of breath, persistent wheezing, shows that there is something wrong.

More CO<sub>2</sub> is excreted during labor, and the rapid breathing helps to keep down

ing impacted in the pelvis the urethra and part of the bladder may slough out, giving urinary fistulas.

In general the kidneys are more active during labor. The polyuria is due to the heightened arterial tension and stimulation of the kidneys through the sympathetic from the uterus. In nervous or hysteric women the general nervous system plays a part. Polyuria is usual, but not constant, some women having less than normal. The full bladder disturbs the course of labor, may prevent the engagement of the head, and in the third stage may delay the exit of the placenta and cause postpartum hemorrhage.

The specific gravity of the urine is reduced, urea, phosphate, and sulphate

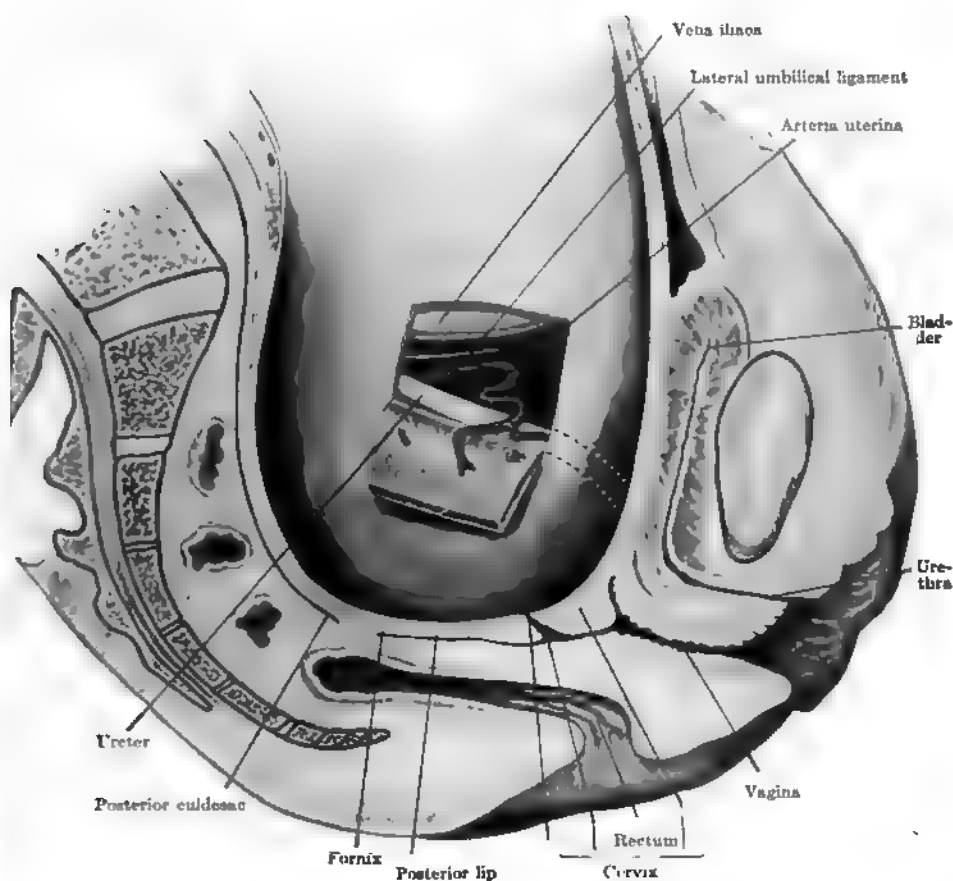


FIG. 157.—THE URETER AT TERM (from Taudler and Halban)

content also, while the sodium chlorid is increased (v. Winckel). Albumin is found in one-third of the cases, being three times commoner in primiparæ, more frequent in very young and very old parturients, in hard and prolonged labors, after the administration of anesthetics, with fever in labor, and in women who have had albuminuria during pregnancy. The amount in normal cases does not exceed 1/1000 each. Larger quantities indicate pathogenic conditions. The cause of the albuminuria may be sought in the increased muscular exertion of labor, the high blood-pressure, and perhaps in the deportation of placental villi (Veit) under the force of the uterine contractions. (See Eclampsia.)

Formed elements, especially hyaline casts, are often found, even white and red blood-corpuscles, all three in proportion to the albuminuria. In general, it may be

said that the urinary findings during labor bear only slightly less significance than at any other time during pregnancy.

**General Metabolism.**—The mother loses about one-tenth of her body weight (Baumm and Gassner). This is made up of the child, the placenta and membranes, the liquor amnii, blood, excretions from the skin, lungs, kidneys, etc. The average

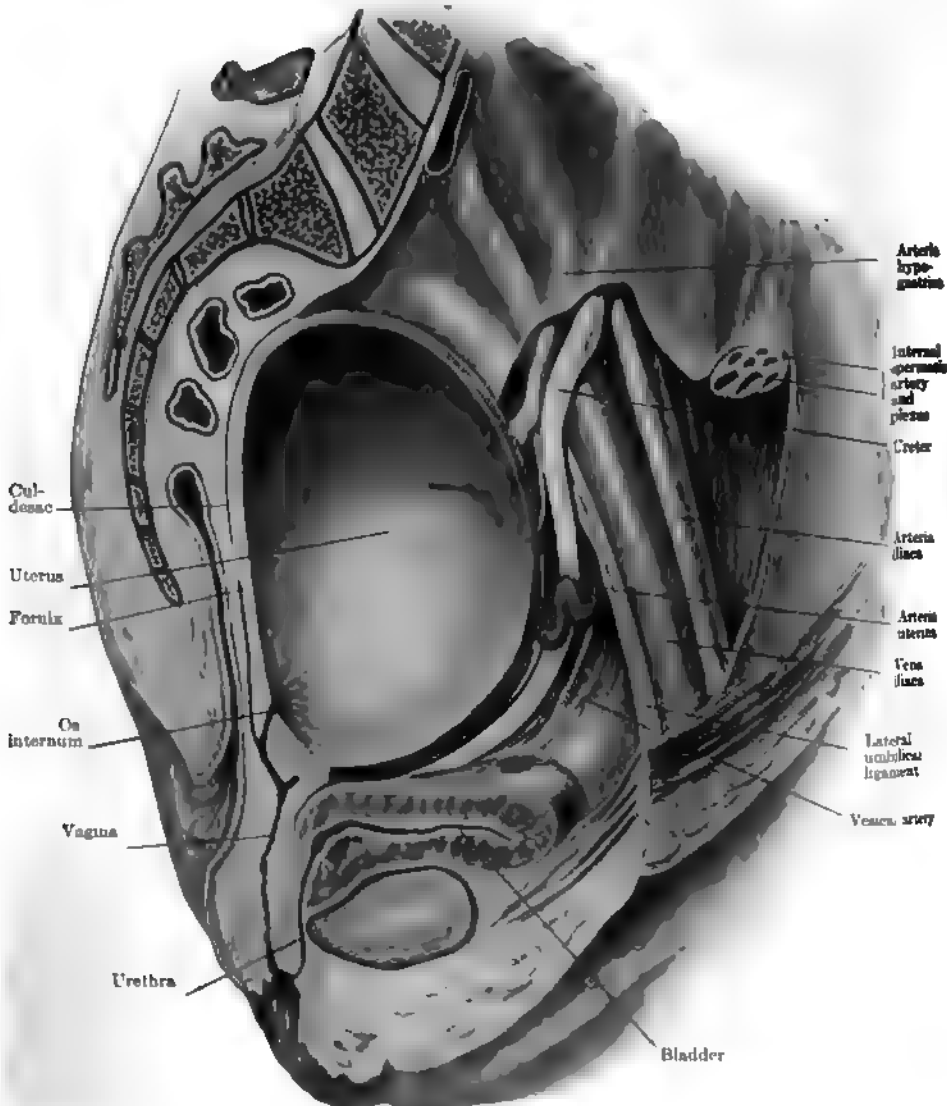


FIG. 158.—TOPOGRAPHY OF THE URETER (Tandler and Halban).

loss is 6564 gm., of which 5000 fall to the ovum, 1000 to the liquor amnii, and there is a loss of about 400 gm. of blood.

A marked leukocytosis is found during labor, which, according to Hofbauer, is due to muscular work, but is more probably an antitoxic reaction. The whites vary from 9 to 34,000. The polynuclear neutrophiles are increased, the eosinophiles much decreased (Cova).

Parturition is the only function normally attended by hemorrhage. Bloodless births are rare, and are so usually because the fetus has been dead some weeks.

the amount of blood lost varies in wide limits from a few ounces to several quarts. Here the normal limit lies depends on the individual patient. Authorities differ as to what should be considered normal. Ahlfeld says even 1000 gm. may be a normal loss, but that the average is 400 gm. The amount of blood lost is influenced by the size of the child, the area of the placenta, its location in the uterus, the rapidity of the separation of the placenta, the strength of the uterine contraction and reaction, the age of the parturient, and the number of children she has borne, being greater in multiparæ. The method of conduct of the labor by the medical attendant also influences the blood loss and pathologic conditions to be later considered. No exact figure may be given as to what is a normal loss of blood in labor. The author believes that 500 gm. should be the limit in ordinary cases, and that in small, anemic, or otherwise debilitated women the loss should not exceed 150 gm. Nearly all the blood comes during and after the third stage, either free or contained in the folded placenta as the retroplacental hematoma. A little blood appears in the "show" at the beginning of the first stage; a little more comes when the last fibers of the cervix are giving way; more may appear when the head bursts through the vulva, from tears of the clitoris and outlet. The bleeding now comes from the placental site and cervical and perineal lacerations, and when the placenta comes, the greatest discharge occurs. The oozing after the delivery of the placenta comes from the placental site and the puerperal wounds, and in the first two hours should not exceed two ounces.

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will find that the infant has filled its mouth with blood or mucus from the vagina. Von Winckel discovered these movements by examinations by the rectum. It is wise to hasten the delivery when such action is discovered, because the infant may get foreign matter into the lungs or stomach and later develop pulmonary atelectasis or intestinal infection. Occasionally the infant will gasp and cry as soon as the head is out, but usually the first cry escapes after the body is delivered. At first the chest moves with tiny excursions; in a few moments a deep gasp fills the lungs, then comes a sneeze or a cough, which expels the mucus from the throat, following which is the lusty cry of the new-born.

**The Cause of the First Respiration.**—The theory of Preyer, that the irritation of the skin from the trauma of labor causes the respiration by stimulating the respira-

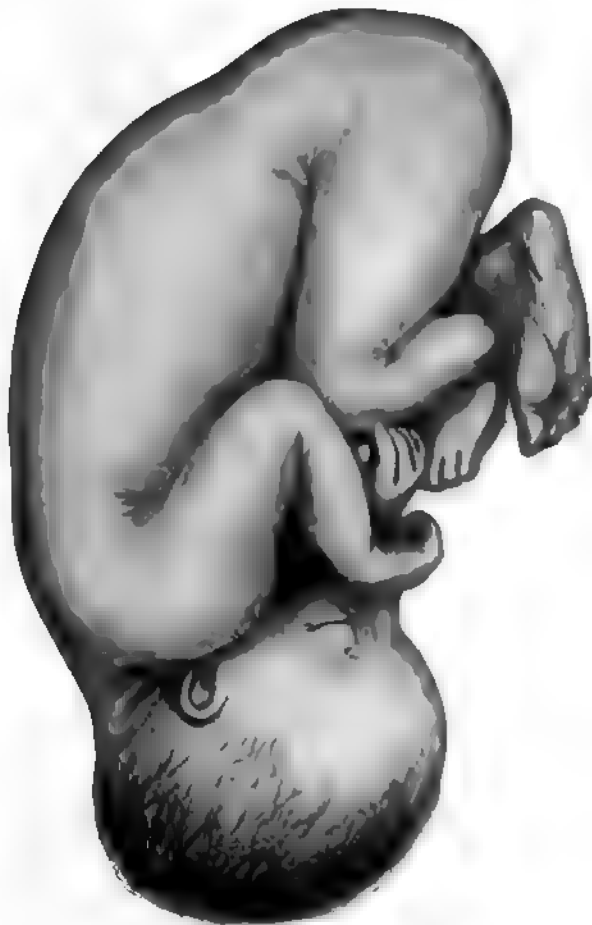


FIG. 160.—ATTITUDE OF CHILD IN UTERO AT BEGINNING OF LABOR.

tory center reflexly, is not probable. The child in utero exists in a state of apnea. Stimuli applied in this condition have no effect on the center, as is shown by clinical experience. Rough palpation, attempts at version, forceps, do not affect the child in utero. Should the child, however, be partly asphyxiated, the respiratory center will react to these stimuli. The theory that the exposure to cold when the child is born causes the respiration has been refuted. Ahlfeld delivered several children into warm saline solution and the respiration began as usual. Again, sometimes a half-minute will elapse before the first gasp occurs, and a reflex should be quicker than this. The most accepted theory is that the gradual deoxidation and hyper-

carbonization of the blood make the respiratory center more irritable (See p. 143). This condition occurs in the latter months of pregnancy, due to the gradual closing of the ducti arteriosus and venosus. During labor this partial asphyxia is increased. When the child's head is born, the placenta is beginning to separate, and its bed is so compressed that little blood can reach the placenta. As the fetus passes from a condition of apnea to one of dyspnea, the respiratory center is irritated, and respiration begins. The same condition occurs when the placental circulation is cut off. A slightly asphyxiated child is

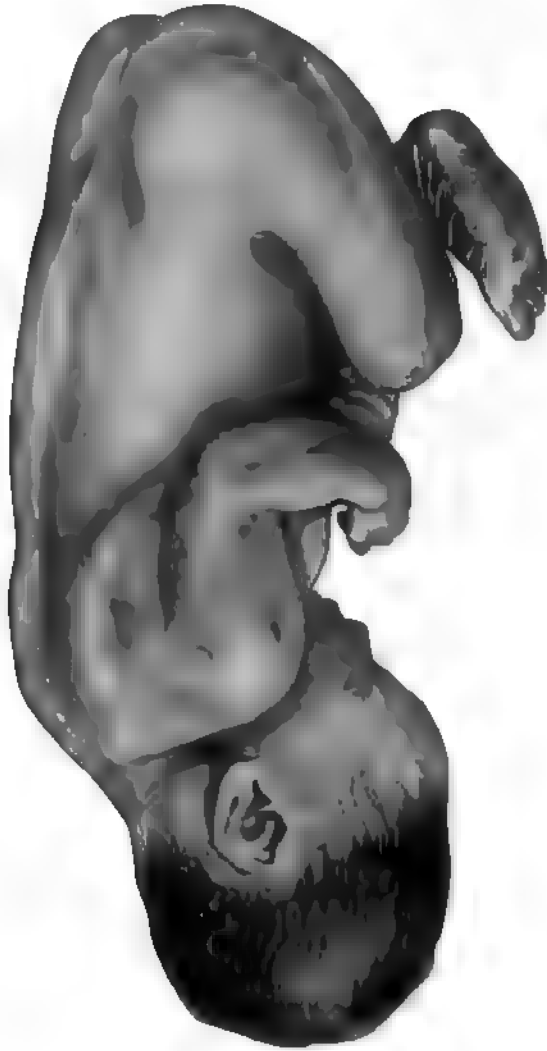


FIG. 161.—ATTITUDE OF CHILD DURING PERIOD OF EXPULSION.

promptly to external stimuli, such as cold, slapping, friction. If the child is delivered, as in cesarean section, or in multiparæ with a short second stage, it comes into the world with sufficient oxygen for a short time; it is in its intra-uterine condition of apnea, and a few minutes may elapse before the respiratory center becomes sufficiently irritated by the increasingly venous blood to evoke respiration.

**The Changes in the Fetal Circulation.**—With the first inspiration the blood

pand. The pulmonary vessels are dilated, and blood rushes into them from the right ventricle. There is no blood to pass through the ductus Botalli. It, therefore, collapses. This may be due to a valve-like formation at its junction with the aorta (Strassman) or to a twisting of the duct, due to the change of position of the heart, caused by the filling of the auricles and distention of the lungs. There is less blood coming from the ascending vena cava, the umbilical vein contracting; the pressure in the right auricle sinks. The result is an aspiration toward the heart of the blood in the vena cava and umbilical vein.

The distal ends of the hypogastric arteries contract and thrombose. This is due to the fact that the left ventricle cannot send the blood the long distance through



FIG. 162.—EXTREME HEAD MOLDING IN A PRIMIPAROUS LABOR.

them, since it is no longer assisted by the right ventricle through the ductus Botalli. Also, cold contracts the arteries, which have a powerful muscular coat. The pulsation in the cord ceases. Since the pressure in the right auricle is low and that in the left higher, the valve of the foramen ovale applies itself to the septum auriculorum, and thus the two sides of the heart become distinct.

The circulation is now just the same as in the adult. The ductus Arantii and ductus Botalli grow smaller by contraction of their muscular fibers and the application of their walls to each other. No thrombosis occurs in them, nor in the vein of the umbilical cord—only in the arteries. They become obliterated in one or two weeks.

**The Plastic Changes Wrought on the Fetus.**—The conditions during labor are unlike those enjoyed by the child during pregnancy. The contracting uterus compresses the fetus into a definite shape, and gives it a certain attitude, both of which

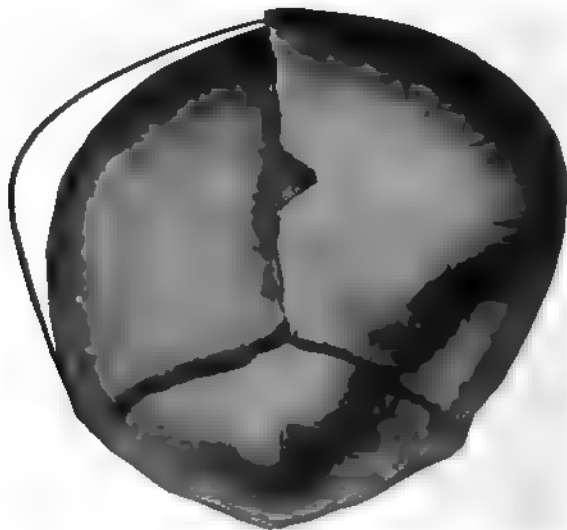


FIG. 163.—REAR VIEW OF SKULL MOLDED IN O.L.A.

are to facilitate its passage through the parturient canal. The legs are flexed on the thighs and crossed over each other, the thighs on the abdomen; the arms are folded across the chest, the head flexed so that the chin rests on the sternum (Fig. 160).

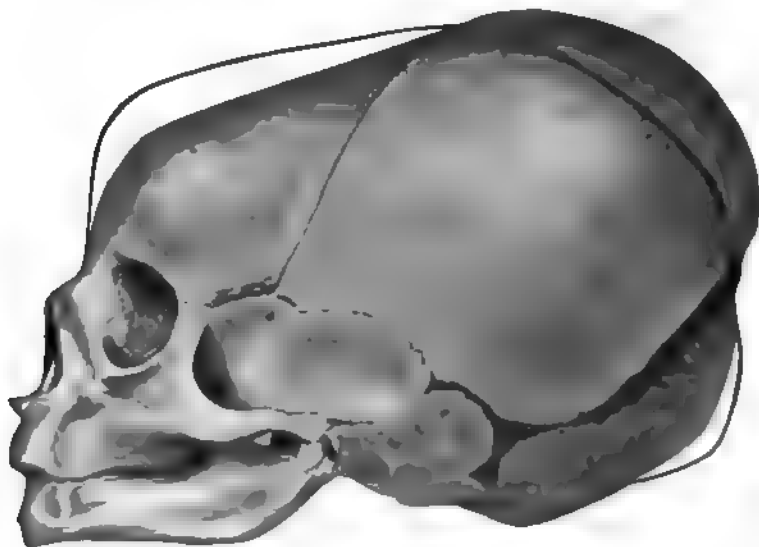


FIG. 164.—SIDE VIEW OF SKULL MOLDED IN O.L.A.

The pressure of the uterus on the crossed legs may bend the tibia and fibula, but the deformity lasts only a week or more.

The head undergoes marked changes, which vary with the presentation of the child for delivery, and are caused by pressure exerted by the maternal structures.

inary head presentations, with a moderately tight parturient passage, the face and forehead are flattened, the occiput long drawn out (Fig. 162), the bones pressed. Usually the occipital bone is pressed under the two parietals—the latter also somewhat below them. One parietal overlaps the other, the one that is against the promontory being the one that is depressed (Figs. 163 and 164). The head offers thus a long narrow cylinder to the birth-canal, instead of a round ball. Changes in shape, or “molding,” are possible because of the softness of the bones and the loose connection they have with each other at the sutures. When molding is absent, labor is more difficult. Some slight diminution in the size of the head occurs in labor, especially if the pelvis is contracted, and it is due to the absorption, under pressure, of the cerebrospinal fluid into the spinal canal. Necessarily, the head is small and cuts little figure in the mechanism of delivery. Along the sutures it is not uncommon to find numerous small hemorrhages in the dura mater and under the external periosteum. They are due to the

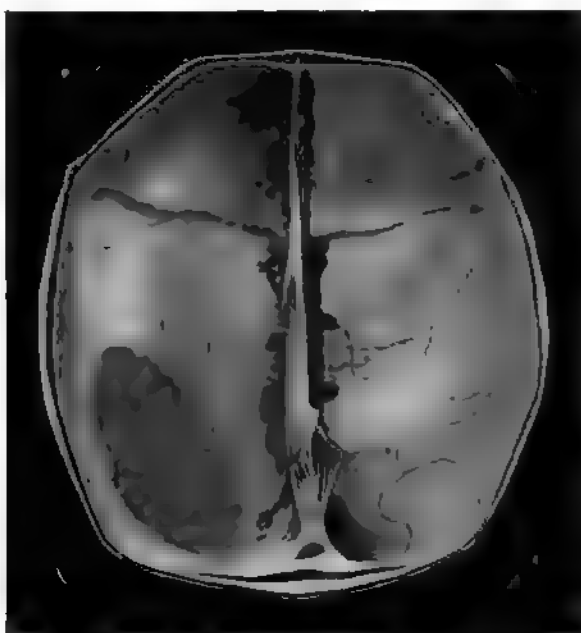


FIG. 165.—EPIDURAL HEMORRHAGES ALONG LONGITUDINAL SINUS.

spacing of the bones, and are most marked in cases where the head has been forced through a narrow pelvis or compressed by the forceps (Fig. 165). On that part of the head least subjected to pressure there appears in long labors a soft, boggy, circumscribed tumor. In vertex presentations it is formed on one parietal bone. It is caused by the pressure of the uterus on the body of the child being greater than on the portion which lies below the girdle of resistance—that is, through the cervix in the cervix or the vagina, or even in the vulva (Fig. 166). The action is similar to that occurring in a limb tightly gartered—the blood cannot return; venous congestion with edema and extravasation of blood results, sometimes a blister. Small hemorrhages persist long after the edema is absorbed, and mark the site of the tumor on the head. The swelling is called *caput succedaneum*, and it occurs under the scalp, not under the periosteum, in ordinary cases. It is, therefore, mobile on the skull. It may sag toward the side on which the child lies after delivery, but the blood extravasations will not change. If the pressure has been prolonged, the hemorrhagic infiltration affects the periosteum, the bone, and correspond-

ing regions of the meninges. A caput succedaneum can form before the bag of waters breaks because the pressure in the bag is less than that in the general uterine cavity, but it is rare. Most commonly we find the largest caput in a contracted pelvis with prolonged and powerful pains, and, second, when the head is arrested at the bony outlet. In either of these cases, but especially in the latter instance, the caput may be visible at the vulva. It may make the attendant believe that the labor is advancing, when, in reality, the growing caput indicates that the head has met an obstruction (Fig. 167). Thus it may give warning of the necessity to interfere in labor. One must distinguish between caput succedaneum and cephalhematoma, which is an accumulation of blood *under* the periosteum. (See Chapter LXII.)

The caput exaggerates the obliquity of the head produced by the depression of the parietal bone by the promontory of the sacrum or the pelvic floor. (See Figs.

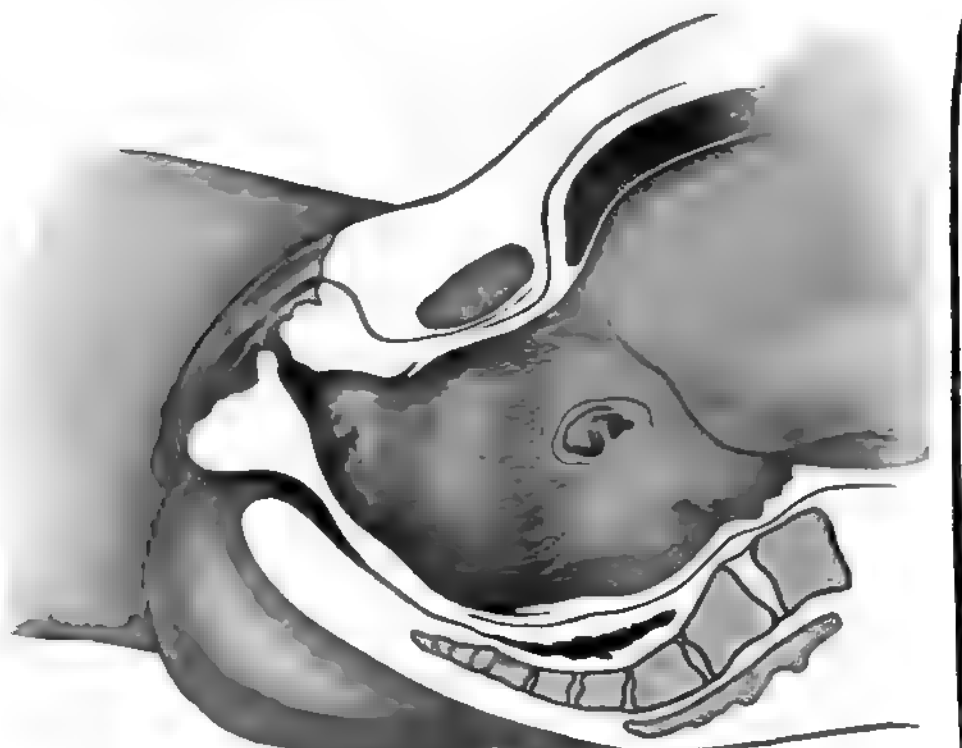


FIG. 166.—SHOWING HOW A CAPUT IS FORMED.

163 and 164.) The caput is absorbed in twenty-four to thirty-six hours; the asymmetry of the head produced by the mechanical factors in labor disappears by the end of a week, but there often remains a permanent asymmetry of the skull, called that of Stadtfeld, who first described it. All forms of growth have a slightly spiral direction. This is true also of the fetus. There is a congenital scoliosis of the spinal column. The right parietal bone is pushed anteriorly in a horizontal plane, appearing flat, while the left is more convex. This asymmetry is permanent and has been demonstrated in the adult. The head tracings to be seen in any hat-shop show it. While the right side is usually affected, the twisting may be reversed. The asymmetry of Stadtfeld may be counteracted by the molding produced during labor. After the latter disappears, the true shape of the skull returns. In *primiparæ* long compression of the head by the lower uterine segment and pelvis results in dolichocephalus, which may be permanent.

Sometimes the head occupies the pelvic cavity for the last three to five weeks pregnancy, and is permanently deformed, flattened by the levator ani. The teroflexion of the trunk shortens the sternocleidomastoid muscle, and during delivery the deformed muscle may rupture, causing hematoma, myositis, and wry-neck.

In breech presentations the head may be flattened by the pressure of the fundus against it for a long time. In a tightly built primipara the flattening may begin in the latter months of pregnancy and may be permanent. Sometimes corresponding shortening of the sternocleidomastoid muscle results from the strained attitude of the child, and wry-neck is produced in the same manner as above stated.

Without doubt labor affects the fetus in more ways than our present means of



FIG. 167.—LARGE CAPUT SUCCEDANEUM SHOWING HEMORRHAGES INTO SKIN.

investigation disclose. Perhaps tiny hemorrhages in the brain may explain some of the so-called congenital deformities and diseases, for instance, strabismus, ptosis, alpebrarum, epilepsy, persistent headache, idiocy. (See page 833.)

#### THE PROGNOSIS OF LABOR

In ideal labor there should be no mortality of either mother or child, but, unfortunately, we are far from this ideal.

In the United States of America, from a registration area of about two-thirds the total area of the country, over 11,500 women die annually in childbirth. (See table on p. 150.) The number seems to be growing all the time.

The increase year by year is explained by the increasing area of registration and the improvement in the statistical reports. Without doubt several thousand

women die in childbirth every year and are buried under another diagnosis. Hundreds die months and even years after, but, nevertheless, from the direct results of labor, from their injuries, from infection, and from operations undertaken to cure them. Then, too, the given statistics cover only two-thirds of the population of the country, though the most densely populated portion. They cover only 37 per cent. of the land area.

#### DEATHS IN CHILDBIRTH IN THE UNITED STATES

YEAR	SEPSIS	ECLAMPSIA	OTHER CAUSES	TOTAL
1902	1813	768	1583	4,164
1903	1992	925	1648	4,569
1904	2291	1075	1743	5,109
1905	2309	981	1787	5,077
1906	2622	1348	2371	6,341
1907	2916	1470	2433	6,719
1908	3284	1619	2441	7,344
1909	3450	1706	2635	7,791
1910	4122*	1824	2509	8,445
1911	4379	2094	2963	9,436
1912	3905	2174	2956	9,035
1913	4542	2397	3071	10,010
1914	4664	2617	3237	10,518
1915	4597	2673	2967	10,237
1916	5201	3087	3354	11,642

W. Williams reviews the mortality in England and Wales from 1847 to 1900. Part of his table is here reproduced:

#### DEATHS IN CHILDBIRTH IN ENGLAND AND WALES

YEAR	TOTAL BIRTHS	SEPSIS	ACCIDENTS OF BIRTHS	TOTAL	RATES PER 1000 BIRTHS OF LIVE CHILDREN
1887	921,693	1836	2414	4250	2.62
1898	923,265	1707	2367	4074	2.36
1899	928,646	1908	2418	4326	2.63
1900	927,062	1941	2514	4454	2.71
1901	927,807	2079	2315	4394	2.49
1909	.....	.....	.....	.....	3.77
1910	.....	.....	.....	.....	3.36

These figures are incomplete because the birth of still-born infants is not recorded, and the mortality of the mothers following such births is not included. Probably the maternal mortality is higher when the labor results in a still-birth.

Newsholme shows that the maternal mortality in England in 1915 is still per 1000, and in Wales 5.75 per 1000.

In Norway Dreyer the mortality in 1904 was 2.8 per thousand, an improvement over 1870, when it was 7 per thousand.

If all deaths were reported, the mortality tables would be still more alarming. At present it is safe to say that of every 200 women who become pregnant, one dies before the reproductive function is completed.

In speaking of these deaths we must distinguish between the preventable and the unavoidable. Without question the mortality of childbirth could be reduced to one per thousand if the public were properly instructed regarding the needful precautions, and if the physicians were all capable of meeting obstetric emergencies, and most important, practised an aseptic technique. It will be noticed in all statistics that nearly half the deaths were from infection.

\*Owing to changes in classification for the year 1910, these figures may not be comparable with those of previous years.



There is an unavoidable mortality in childbirth, and it comes from disease the uterus, adnexa, and pelvis, and from general affections aggravated by sturition, but it is small compared with the preventable mortality.

Labor shows a high morbidity, that is, the women are sickened or injured in the process of reproduction. The author has never seen a woman as anatomically perfect after delivery as she was before pregnancy occurred. Many women date long invalidism from a confinement. Overdistention of the abdomen often gives weakness of the abdominal wall and visceroptosis; the urogenital septum is always torn, and prolapse of the urethra and anterior vaginal wall occurs, the patulous vulva opening the way for infectious catarrhs of the bladder and of the cervix and chronic metritis; laceration or overstretching of the pelvic floor is an almost variable occurrence in greater or less degree, inviting prolapse of the uterus—these are some of the inevitable consequences of labor. If to these be added the frequent infections of the uterus and adnexa, the damage to the soft parts from operative deliveries, disease of the kidneys, of the liver, etc., one quickly appreciates the high morbidity of the reproductive function in the human female in our day. Naturally, it is impossible to compile statistics as to the frequency of these affections, but the records of the hospitals show a continual stream of women seeking relief from the bad effects of childbirth. Most of these diseases and accidents can, even from our present knowledge, be prevented, and no field in all preventive medicine promises greater results.

**Prognosis for the Infant.**—The highest mortality that befalls the human race on one day occurs on the day of birth. Schultze estimates that 5 per cent. of children are still-born, dying during labor, and 1.5 per cent. die shortly after birth, the result of the trauma of labor. Brothers found that in New York city, in the four years from 1889 to 1892, over 16,000 children were born dead or died immediately after labor. Cragin found 4.58 per cent. of stillbirths at Sloane Maternity in 1913.

Chicago about 2000 children die annually from birth accidents (Evans). In Paris 9 per cent. die; in Glasgow, 13.6 per cent.; in Edinburgh, 11.5 per cent. (See Ferguson.) It is safe to say that in the United States 250,000 children die annually during delivery. Asphyxia and injury during labor are frequent causes of fetal death, but a large part of the mortality is due to congenital defects, syphilis, alcoholism of the parents, and general diseases.

Besides this mortality, the children are frequently injured during delivery, either by the natural powers or, and more often, by operative procedure. Hemorrhages into the brain, tentorium tears, fracture of the skull, dislocation and fracture of the vertebræ, joints, and extremities, often result from the brutal deliveries rendered necessary in cases of mechanical disproportion. Milder injuries of brain, nerves, and bones are very frequent, but are often overlooked until their later effects become prominent; for example, Little's disease from injury to the brain and spinal cord, chronic hydrocephalus, athetosis, idiocy, etc.

One such brief glance into the subject will show the immensity of this field of preventive medicine, and prove to the reader that obstetrics is not one of the minor branches of medicine, but a specialty deserving the attention of the best minds in the profession.

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## CHAPTER IX

### THE MECHANISM OF LABOR

THE details of the wonderful process of parturition, whose clinical manifestations we have just considered, deserve separate study. The mode and manner by which the ovum is separated and extruded from the uterus comprise the mechanism of labor, and deserve the closest attention of the practising obstetrician. Indeed,



FIG. 168.—INTERNAL UTERINE PRESSURE (I.U.P.). EFFECT OF UTERINE CONTRACTION.

without accurate knowledge of this mechanism he ceases to be a scientific practitioner and becomes a midwife. The accoucheur who knows the science of the mechanism of labor will early recognize deviations from the normal, and, by some simple, harmless manipulation, may direct the course of labor into the normal again. He also will be able to deal with the pathologic mechanisms with the least possible danger of injury to the mother and child. The ignorant accoucheur, on the other

ad, will allow the labor to go on until positive obstruction exists and the lives of parent and child are placed in jeopardy. Then he must use brute force to overcome mechanical difficulty, with the almost invariable result of severe maternal injury and frequent destruction of the child. Although a daily occurrence, and the object of a century of study by the most eminent accoucheurs, the intricate processes of parturition are not all understood, and many of them are not yet satisfactorily explained.

The subject falls naturally into the consideration of three factors: first, the *powers*; second, the *passages*; third, the *passengers*. After this the action of the



FIG. 169.—ACTION OF THE UTERINE LIGAMENTS.

powers on the passengers in forcing them through the prepared passages must be studied.

**The Powers.**—The uterus is the main driving engine, with the abdominal muscles as a powerful auxiliary. Gravity, that is, the weight of the child, is of small influence, while the elastic contraction of the vagina and perineal floor has hardly any effect on the propulsion of the ovum.

When the uterus contracts, it exerts equal pressure on its contents in all directions, obeying the law of pressure on fluids. If the pressure were met all over by equal resistances, it would return to the uterine wall nullified, but since there is a weak spot in the uterine wall, the lower uterine segment and internal os, the contents of the uterus will all be forced in this direction. The resultants of all the forces

applied to the bodies in the uterus will point toward the internal os (Fig. 168). This hydraulic pressure is the most important factor in the work of the uterus, but other factors have been invoked. Lahs and Schatz believed that the uterus, compressing the fetus from side to side, lengthened its spinal column, forcing the breech against the fundus and the head downward into the pelvis. This pressure is called the *fetal axis pressure*, and is absent in polyhydramnion, and with a small or macerated fetus. The change of the C-formed spinal column to the straighter form results in a lengthening of the fetal cylinder of 10 cm. Whether the uterus presses on the

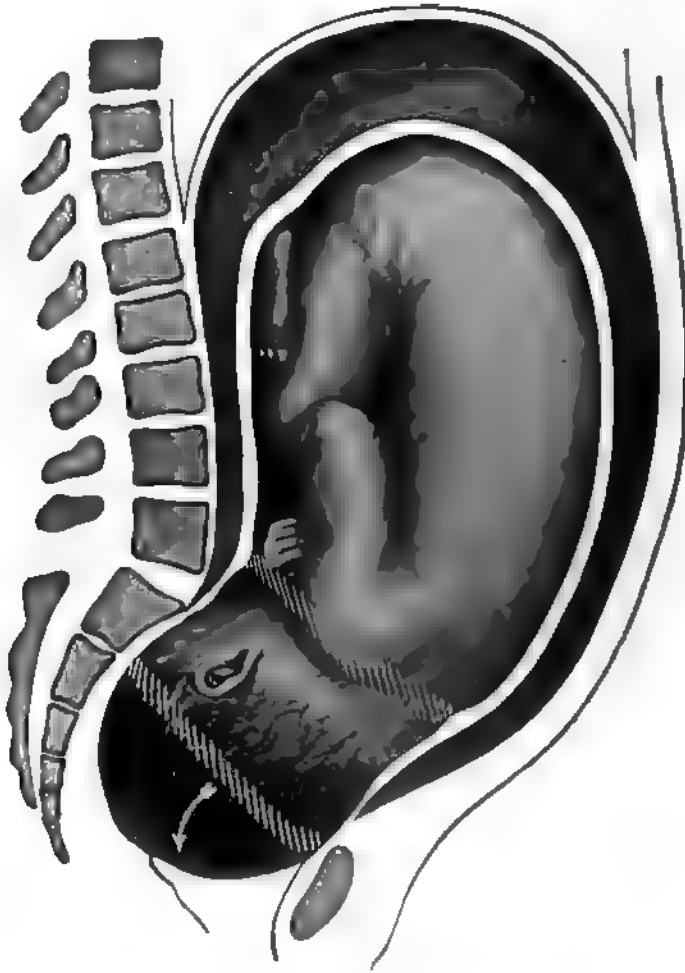


FIG. 170.—ACTION OF THE INTRA-ABDOMINAL PRESSURE IN AUGMENTING INTRA-UTERINE PRESSURE.  
Girdles of resistance indicated by white lines.

pelvic extremity of the fetal axis and thus causes an advance of the child or not is still a disputed question, with the decision probably in the negative.

Intra-uterine pressure accomplishes—(1) The protrusion of the bag of waters; (2) the dilatation of the lower uterine segment and cervix; (3) it causes edema and succulence of the soft parts—the so-called “vital dilatation”; (4) the expulsion of the fetus and placenta.

The round, the uterosacral, and the broad ligaments have important functions. They are part of the uterus,—mere extensions of its muscle-fibers,—and contract when it contracts. These bands serve to moor the uterus to the

is and prevent too great retraction above the child. The round ligaments the fundus forward and bring its axis parallel with the axis of the inlet (Fig. . The uterosacral ligaments pull the cervix backward and downward and also open up the lower uterine segment and upper cervix. All the ligaments, by force exerted, increase the intra-uterine pressure and help expel the fetus.

The abdominal pressure is a powerful auxiliary in labor, and may substitute uterine contraction more or less completely. During the first stage the abdominal muscles do not, and should not, take any part in the process of labor, but in the second stage they are called upon to assist and complete the work of the uterine contractions. During an expulsive pain the woman closes the glottis and makes a powerful bearing-down effort. She forces down the diaphragm and contracts the recti, the obliqui, and the muscles of the flanks. There is now a great increase of the intra-abdominal pressure, which, obeying the law, is transmitted equally in all directions, the uterus receiving its share. It is easy to see how the abdominal pressure is simply added to the intra-uterine pressure, resulting in increased general intra-uterine pressure (Fig. 170).

After the dilatation of the cervix the abdominal muscles alone are able to expel the child, and usually do it, since the uterus by this time has retracted so high over the fetal cylinder and its muscle-fibers are so shortened that it has very little expansive power.

In pathologic labor the abdominal muscles are particularly useful in overcoming the abnormal resistances, in preventing uterine rupture by restraining the upward displacement of the uterus, and in other ways. In the third stage of labor the placenta is expelled by the exertions of the abdominal wall, but only after the placenta is separated and lies in the lower uterine segment and vagina.

The power of the uterine contraction cannot be accurately measured. Duncan tried to do it by testing the resistance of the fetal membranes. The force necessary to rupture them varies greatly. Schatz, with his tokodynamometer, a rubber bag half filled with water, lying in the uterus, connected with a manometer, found that the uterine contraction during the first stage showed a pressure of from 17 to 55 pounds, and during the second stage, when the force of the abdominal muscles was added, it was about doubled. Clinically, the power of the uterine contraction may often be appreciated. It may crush the baby's head or fracture its bones. The accoucheur's hand in the uterus may be squeezed so hard that it becomes insensible and paralyzed. In rare cases tumultuous action of the uterus and abdominal muscles may eject the infant from the vulva with much force. Probably the ordinary amount of force exerted by the uterus and abdomen rarely exceeds 30 pounds.

Gravity plays but a small rôle in labor. The difference in specific gravity of the fetus and its liquor amnii is not great. The constant slight pressure exerted by the head on the lower uterine segment may soften this portion of the uterus, or it may elicit stronger pains. One often observes that a change of the parturient's position, which brings the weight of the fetus onto the cervix, such as walking or sitting up, will strengthen the uterine contractions.

## CHAPTER X

### THE PASSAGES

THE fetus has to traverse a bent passage, which is partly bony and partly fibrous and muscular. The bony portion is the pelvis, which is divided into two parts by a ridge called the *linea terminalis*. The upper, large, or false pelvis is of little obstetric interest. It is made up of the flaring iliac plates at the sides, the spine behind, and the gap in front over the pubis is filled in by strong abdominal



FIG. 171.—NORMAL FEMALE PELVIS.

muscles. The false or upper pelvis is shaped like a flat funnel, and forms a support for the uterus and child during pregnancy, directing the latter into the true pelvis at the proper time. The shape and size of the false pelvis, too, give the obstetrician some conception of the shape and size of the true pelvis. (See p. 239.) The true, lower, or small pelvis (*pelvis minor*) is of immense obstetric importance, since it supports the muscles of the pelvic floor and gives shape and direction to the per-

transient canal, itself forming part of same. A plaster cast of a true pelvis, as first made by Hodge, shows its cavity to have the shape of a cylinder with a bluntly pointed exaxial lower end. It is very slightly curved anteriorly. The entrance and outlet of the true pelvis are smaller than the middle portion, and have, therefore, been called straits—the superior and inferior. The region between, being large and roomy, is called the excavation. Anteriorly, the canal is short— $4\frac{1}{2}$  cm.; posteriorly, long, the length of the sacrum— $12\frac{1}{2}$  cm. Laterally, the pelvic canal is longer, and the sides narrow slightly from above downward, especially behind, near the spines of the ischia, but broadening out below at the tuberosities. The contour of the canal, therefore, varies much at different levels, and it is customary to describe these variations by means of planes drawn more or less arbitrarily through the pelvis. It must be clearly understood that the so-called planes about to be described are

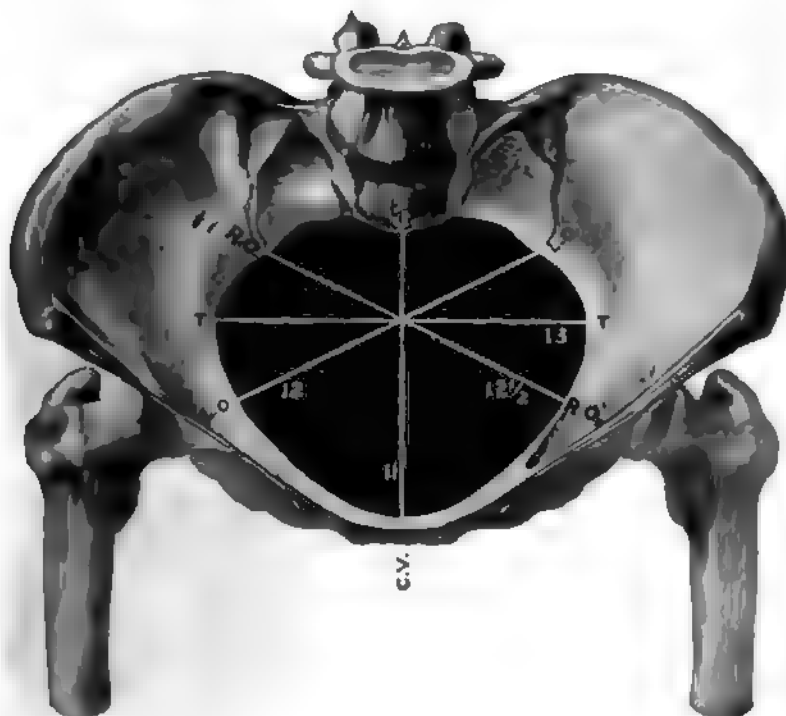


FIG. 172.—THE PELVIC INLET WITH DIAMETERS.

really not such in a geometric sense, but represent regions or portions of the pelvis, and have three dimensions.

The plane of the inlet, brim, superior strait, isthmus, margin, or apertura pelvis superior, is bounded by the upper border of the pubis in front, the linea innominata or *linea terminalis* at the sides, and the sacral promontory behind (Fig. 172). This plane is heart-shaped—that is, a transverse ellipse on which the sacrum intrudes behind. The depth of the region of the inlet is about 2 cm., and represents the distance from a line drawn in the pubosacral diameter to a transverse line in the lowest level of the *linea terminalis*. (See Fig. 173.) It is deeper behind than near the pubis, and varies very much in all three dimensions—that is, in shape and depth. (For detailed description see chapter on Contracted Pelvis.) The inlet is a very important region of the pelvis, because contraction and distortion of the bones, due to disease, are likely to be marked here, and, further, it is an important factor in normal labor. Its diameters are, first, the anteroposterior, pubosacral, or *conjugata vera* (C. V.), named by von Roederer, extending from the top of the pubis to the

tip of the sacral promontory, measuring  $11\frac{1}{2}$  cm. This is the true or anatomical conjugate. The shortest anteroposterior diameter is from a point 1 cm. lower on the surface of the pubis to the promontory, and is called the obstetric conjugate (Michaëlis), because intimately concerned in the mechanism of labor, especially in contracted pelves. It measures 11 cm. in the normal pelvis, but may be reduced a few centimeters in abnormal pelves. When we speak of a pelvis of 8 cm. we mean one with a C. V. of 8 cm. It is impossible satisfactorily to measure the C. V. on the living, though numerous instruments are vaunted for the purpose. We can gather an approximately correct idea of its length from the measurement of the distance from the under margin of the pubis to the promontory. This diameter is



FIG. 173.—THE REGIONS OF THE PELVIS.

called the *conjugata diagonalis* (C. D.), and is, in normal pelves, about  $11\frac{1}{2}$  cm. longer than the C. V. obstetrica, that is, about  $12\frac{1}{2}$  cm. (See Pelvimetry, p. 243.) Transversely, the inlet measures 13 cm., while the two obliques measure 12 and  $12\frac{1}{4}$  cm. respectively. The oblique diameters are named first and second or, better, right and left, using the sacro-iliac joints as the denominator, according to the recommendation voted at the Congress at Washington in 1887 (Bar). The right oblique extends from the right sacro-iliac joint to the left iliopubic tubercle; the left, between corresponding points. They are important diameters, because the head usually enters the pelvis in one or the other. Since most individuals step harder on the right foot, and since they also have a slight right scoliosis, the right half of the pelvis is a bit flattened, and the left oblique, therefore, a trifle shorter than the right. The inlet



ed upon by the iliopsoas muscles (Fig. 175), but probably not enough disturb the mechanism of labor. If the child should be large and the l developed, the muscle might delay the engagement of the head. Pos-  
x the muscle would relieve the obstruction.

ide pelvic plane is one passing from the middle of the pubis to the junc-  
second and third sacral vertebræ (Fig. 176). It is about the center of  
called the "excavation" of the pelvis, and is, therefore, sometimes called  
ne, this latter term being much used in operative obstetrics. This plane

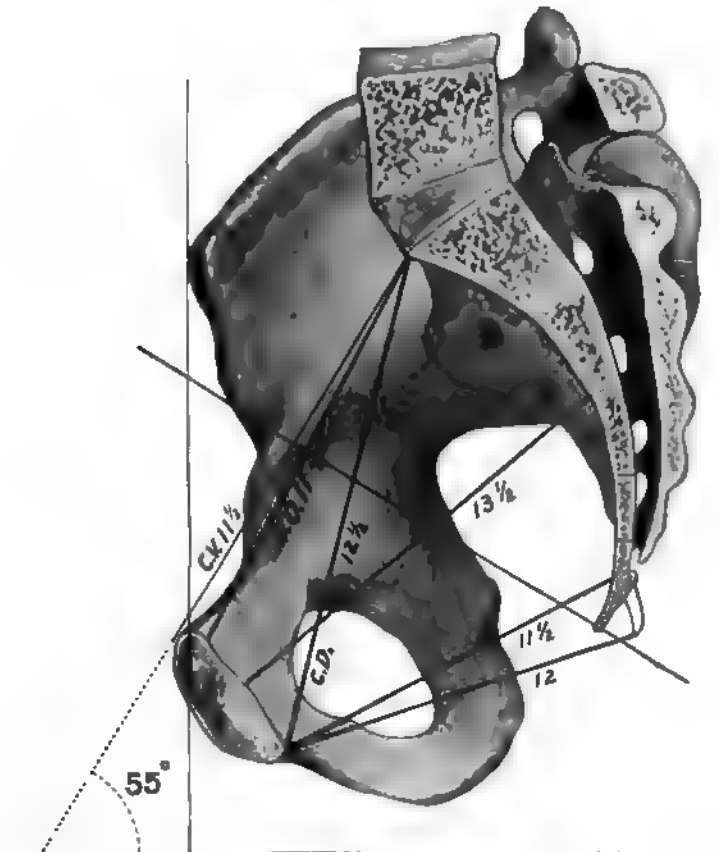


FIG. 174.—SAGITTAL SECTION OF PELVIS SHOWING DIAMETERS (Hodge).  
C. V., Anatomic conjugate; C. V. O., obstetric conjugate; C. D., diagonal conjugate.

ly ovoid, occupying the roomiest portion of the pelvis, and with an  
erior diameter of  $13\frac{1}{2}$  cm. and a transverse of  $12\frac{1}{2}$  cm.

arrow pelvic plane passes through the apex of the pubic arch, the spines  
ia, and the end of the sacrum (Fig. 177). This is the smallest strait of  
and is frequently the site of contracture, a fact which is only lately being  
appreciated. This plane is ovoid, with the large end anteriorly and the  
l behind, formed by the sacrospinous ligaments. Owing to the incurvation  
es of the ischia and the attachments of the levator ani muscle and fascia,  
n its passage, is crowded into the anterior portion of this plane. Its most  
diameter is that between the spines— $10\frac{1}{2}$  cm. An imaginary line drawn  
e spines of the ischia is used to determine the descent of the head into

The narrow pelvic plane is important also because it is the beginning  
l of the cylindric birth-canal. In labor, the head descends straight into

the pelvis until it reaches this plane, then begins to rotate and slide forward on the pubis.

The **plane of the outlet** passes through the arch of the pubis, the rami of pubes, the tuberosities, and the tip of the coccyx. This plane is the lower bound of the region of the bony outlet, and is not seldom the seat of contracture. There are really two planes, roughly resembling triangles bent at their applied bases or tuberosities. During labor the head pushes the coccyx back (Fig. 174), brings the two parts more into one plane, and at the same time increasing the anteroposterior diameter from  $9\frac{1}{2}$  to 12 cm. The transverse diameter of this plane is important—11 cm.

The above is a description of the classic pelvic planes dating from the time

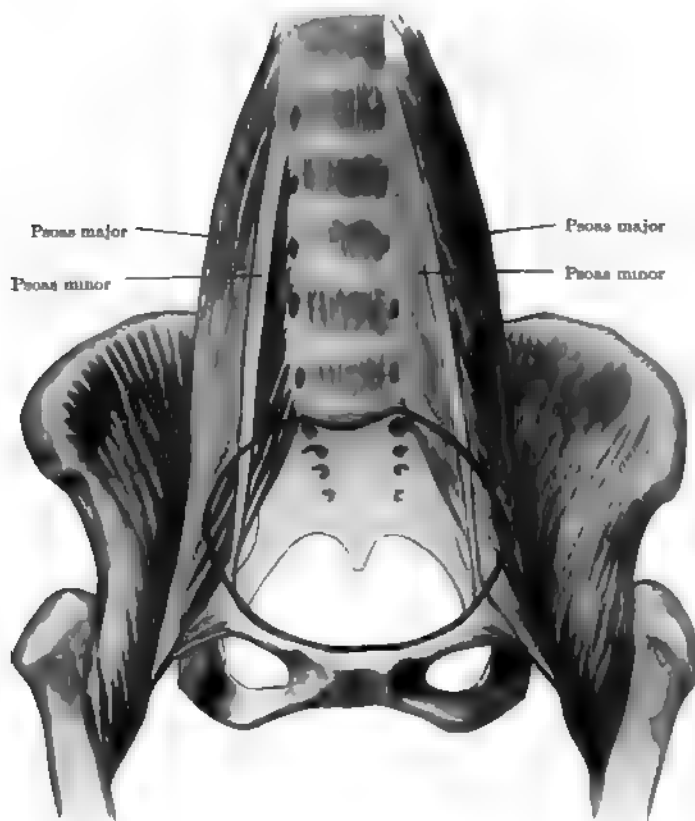


FIG. 175.—SHOWING INLET ENCROACHED ON BY ILIOPECTINEAL MUSCLES.

Levret (1770). Hodge, of Philadelphia, constructed a series of more arbitrary planes, all running parallel to the inlet (Fig. 179). The first parallel is in the inlet, the second parallel, called by Veit the "chief plane," touches the arch of the pubis and strikes the lower part of the second sacral vertebra; the third cuts the spine at the ischia, and the fourth goes through the tip of the coccyx and represents the pelvic floor. The Hodge system never obtained general recognition, and one modern author calls it obsolete, but Sellheim, to whom we owe much in the study of the mechanism of labor, recently (1909) declared it the only scientific method for the study of the pelvis and the mechanism of labor, and recommended its general adoption by teachers and writers. It is a fact that the head enters the pelvis in the

the inlet, passing successively through these planes, and, too, since we can easily determine the location and direction of the inlet, it is a simple matter to orient oneself as to the location of the planes parallel to it. The author has used the same system of planes in his studies of the mechanism of labor, and agrees with Leim as to their scientific worth. In the comparative study of contracted pelvises (Fig. 176) and in gynecologic diagnosis they are equally valuable.

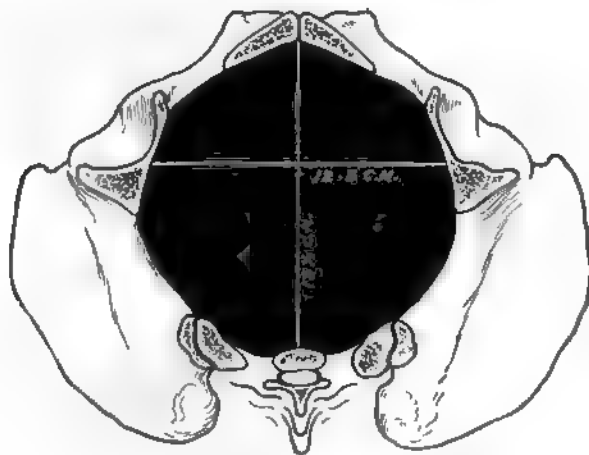


FIG. 176.—WIDE PELVIC PLANE.

Passes from the middle of the pubis to the junction of the second and third sacral vertebrae.

When the woman is in the erect position, the inlet makes an angle of about 55 degrees with the horizon, but this varies from 40 degrees to 100 degrees, depending on the rotation of the thighs and the carriage of the shoulders. This is called the *inclination pelvis*. A quick method to determine if this inclination of the pelvis is normal is to see if the anterior superior spine of the ilium and the pubis are in a vertical plane. In the lying position the inlet is 25 degrees below the horizontal.

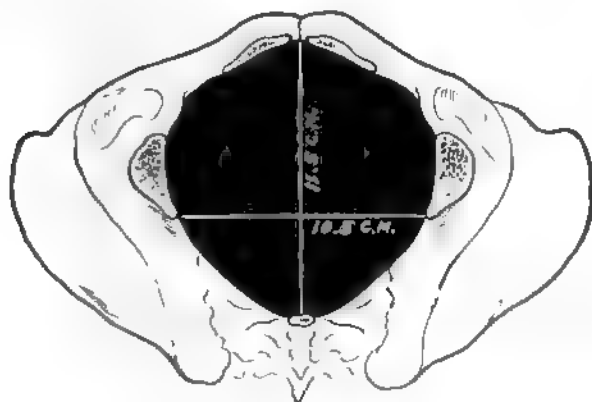


FIG. 177.—NARROW PELVIC PLANE.

Passes through the apex of the pubic arch, the spines of the ischia, and the tip of the sacrum.

The crests of the ilium run about parallel to the plane of the inlet. Formerly, great importance was attached to the pelvic inclination as affecting the mechanism of labor, but lately not much.

Contrary to what would be expected, the pelvis is not a solid and fixed bony

structure. The coccyx is easily pressed back by the advancing head, enlarging outlet 2 to 2.5 cm. The pelvic joints are fixed by strong ligaments, but during pregnancy these soften and allow a certain degree of mobility to the bones. When they do not permit much actual enlargement of the pelvic cavity, as believed



FIG. 178.—THE PELVIC OUTLET.

Passes through the arch of the pubis, the rami pubis, the tuberosities, and the tip of the coccyx.

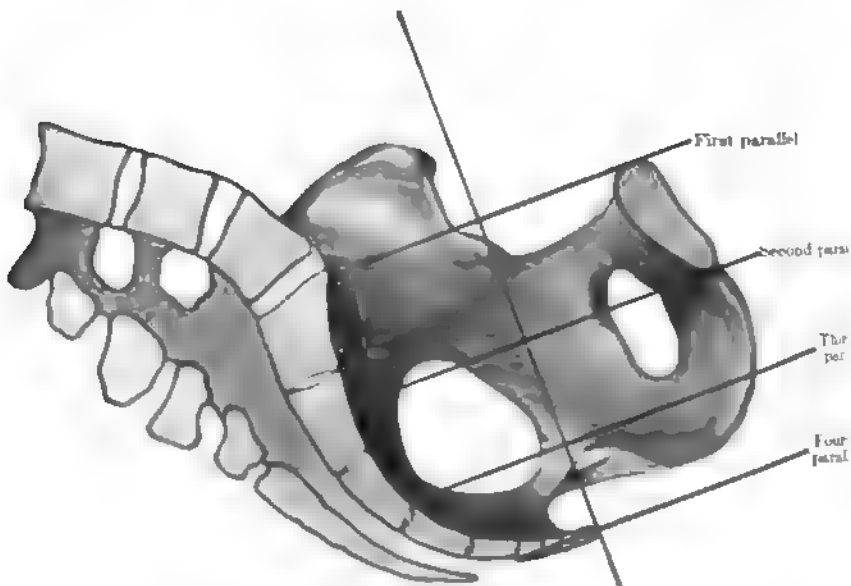


FIG. 179.—HOOVER'S SYSTEM OF PARALLEL PELVIC PLANES.

ients, and as occurs in many animals, the loosening of the joints allows the hips to rotate on the sacrum when the body is bent into forced extension and flexion. Thus, the sacrum being fixed, the pubis moves downward when forced extension of the thighs is made,—Walcher's position,—enlarging the inlet by 0.5 to 1 cm. (Fig. 190). In forced flexion, the knees being pressed against the abdomen, the pubis is carried up, the ossa innominata rotate upward and dip outward, enlarging the outlet of the pelvis. These changes in the shape of the pelvis are made use of in the conduct of labor. (See Chapter LVIII.)

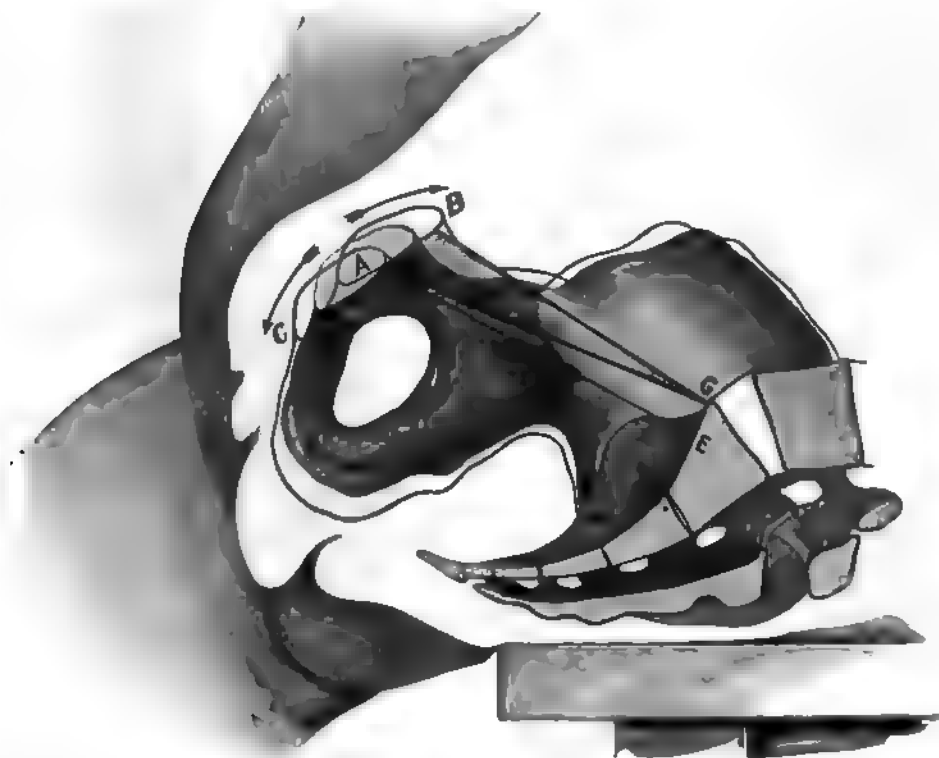


FIG. 190.—SHOWING THE MOBILITY OF THE PELVIC JOINTS IN FLEXING AND EXTENDING THE THIGHS. A represents the pubis when the patient lies flat on back, B, when the thighs are strongly flexed on the belly; C, when the legs are allowed to depend fully. A-B shows the available conjugate in the Walcher position, and the shaded area the gain in space in the region of the inlet.

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#### THE SOFT PARTS

Fig. 175 shows the relation of the psoas and iliacus muscles to the inlet. It will be seen that they give it a more quadrangular shape; that they encroach but little on its lumen; and that only in cases of transversely contracted pelvises will they interfere in the mechanism of labor. The rectum lies on the left side behind, and projects into the cavity only when filled. It may thus cause dystocia. The midplane is encroached on by the obturator internus and behind by the pyriformis—very slightly, however. The nerves in the pelvis make no obstruction, and, owing to the projecting spines of the ischia and the forward dip of the pelvic floor, rarely are

subject to pressure. When they do suffer pressure, the parturient has pains running down the legs and up the back. The peritoneum and fat count very little in the general configuration of the parturient canal, as was proved by Hodge with plaster casts.

The cervix and the lower uterine segment have already been considered. Of most obstetric interest is the pelvic floor. This consists of those soft tissues which fill out the irregularly shaped outlet of the pelvis. A great many structures enter into its formation—the pelvic fascia, the levator ani and coccygeus, the deep and superficial transverse perineal muscles, the constrictor cunni, the urogenital septum, fat and skin, and the organs—rectum, vagina, and urethra. Careful dissection and embryologic study enable us to distinguish two diaphragms in the pelvic floor (Holl)—an upper stronger, a muscular system, modified from that formerly used for the tail, and a lower, weaker, developed from the sphincter cloacæ, which closes the orifices in the pelvic floor.

The diaphragma pelvis rectale, or proprium, shortly referred to as the pelvic

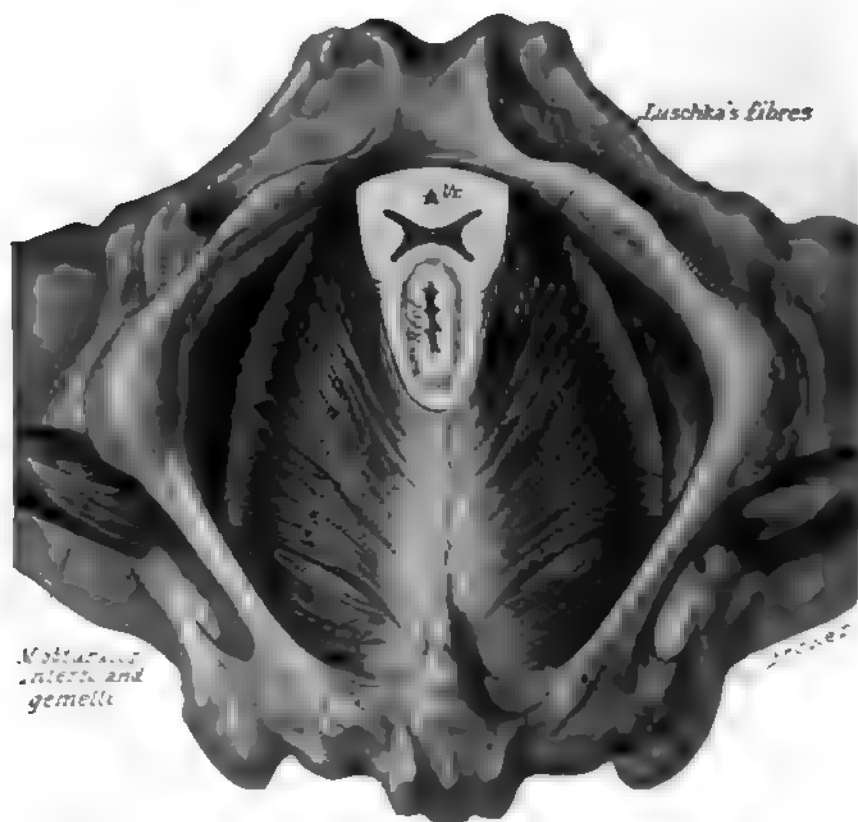


FIG. 181.—LEVATOR ANI FROM BELOW.

floor or diaphragm, is made up of the levator ani and the coccygeus, together with the pelvic fascia above and below. Anteriorly, the muscle is attached to the back of the ramus of the pubis, leaving an incomplete space, 2½ cm. wide, behind the symphysis. It extends on either side across the opening of the obturator foramen, being attached to the fascia covering the obturator internus muscle by the "white line," or arcus tendineus musculi levatoris ani. On vaginal examination this arcus tendineus, or junction of the fascia obturatoria, with the fascia diaphragma pelvis

superiora, can often be felt by the finger. The insertion of the muscle extends to the spines of the ischia. From this extensive area of insertion the muscle-fibers pass downward and inward toward the median line. Posteriorly, they come together at the lower end of the sacrum and the coccyx; anterior to this they interlace in the median line behind the anus; next they fuse into a sling-like hammock under the perineal curve of the rectum; finally a very few fibers meet between the anus and vagina in the perineal body (Luschka's fibers). Holl gave different portions of the broad muscle special names. That portion going from the spine of the ischium to the coccyx he called the ischiococcygeus; that from the arcus tendineus to the raphé, the iliococcygeus; that from the posterior surface of the pubis, passing alongside the urethra, vagina, and rectum, to meet its fellow in a tendinous raphé extending from the tip of the coccyx toward the rectum, the pubococcygeus; and, fourth, a strong band running from the pubis around the lower part of the rectum, sling-like, the puborectalis. A very few of these fibers pass in front of the rectum to the perineal body; a few attach to the rectum and skin (Fig. 181). The diaphragm thus resembles a concave broad horseshoe, incomplete in front, leaving an elliptic opening. Through this elliptic space pass the urethra, vagina, and rectum. The sides of the muscle slope together in the middle, forming a V-shaped gutter, leading down under the arch of the pubis. Fig. 182 shows the distribution and action of the various portions of the levator ani and the opposing action of the

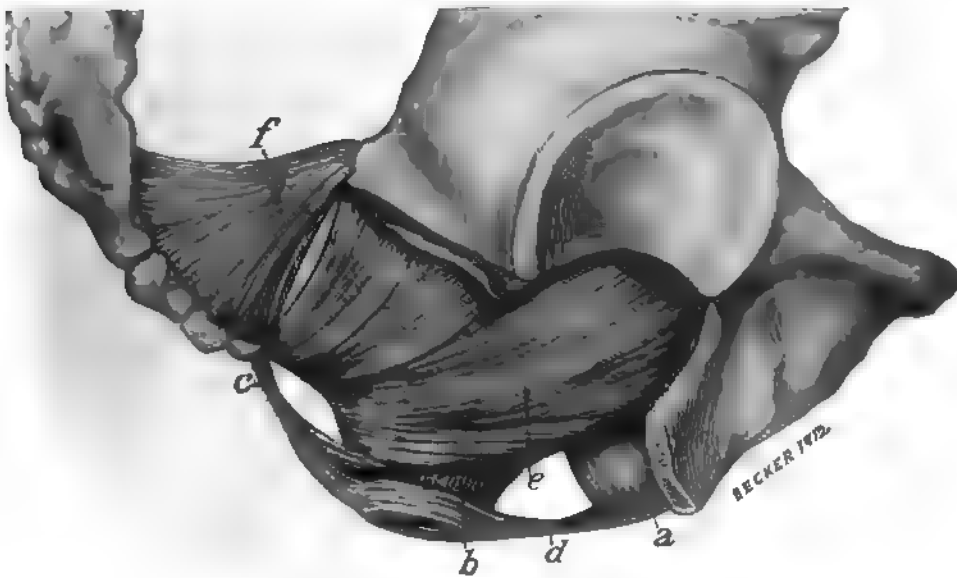


FIG. 182.—SHOWS LEVATOR ANI FROM SIDE—SLING-LIKE ACTION.

a, vagina; b, rectum; c, posterior fibers of sphincter; d, anterior fibers of sphincter ani; e, levator ani; f, musculus coccygeus (somewhat modified from Luschka).

sphincter ani. When the levator contracts it pulls the rectum and vagina up against the pubis; when the sphincter contracts it draws the anus and the lowest portion of the rectum backward, the result of the two forces being to bend the rectum, closing it most effectually. On vaginal examination the puborectal portions of the levator can easily be felt as two roundish pillars at the sides of the vagina and when they contract the finger is raised up to the pubis. Beneath the pelvic diaphragm lie the ischiorectal fossæ, the perineal body, the diaphragma urogenitale, the vulva, and its glands. Of these we need consider only the diaphragma urogenitale (Fig. 184), which closes the hiatus genitalis. This is a three-cornered, musculo-

fibrous septum, fitted into the pubic arch and extending backward to the anterior wall of the rectum. It is made up of the deep layer of the perineal fascia, inclosing the fibers of the *musculus transversus perinei profundus* and the *compressor urethræ*. A few of these fibers reach around the vagina and are called the *sphincter urogenitalis* (Kalischer). On this septum lie the *musculi bulbocavernosi* (*sphincter cunni*), the *ischiocavernosi*, and the *transversi perinei superficiales*. These muscles, mostly rudimentary, center at a point between the rectum and the vagina called by Waldeyer the *centrum perineale*, or *centrum tendineum perinei* (Holl), or perineal body. The perineal body is a pyramidal structure, lying between the rectum and vagina, with its apex in the pelvic diaphragm. Its base is the skin between the anus and the vulva. Its anterior wall is the vagina and *fossa navicularis*, the posterior wall, the anus and rectum; at the sides it broadens out into the ischiorectal fossæ. It is composed of fat, fasciæ, the rear part of the urogenital septum, the fused ends of the transverse perineal muscles, the *bulbocavernosi*, the anterior fibers of the *sphincter ani*, and the skin. It has great obstetric importance, but not so much as that of the pelvic floor, a point frequently overlooked. During labor the perineal



FIG. 180.—PERINEAL FLOOR.  
ANTERIOR VIEW.

body is flattened out, its apex is pressed down and back, so that its structures come to lie on the distended pelvic diaphragm.

The *sphincter ani externus* lies between the skin and the pelvic diaphragm, surrounding the lower end of the rectum. It is attached posteriorly to the coccyx



by the ligamentum anococcygeus, and anteriorly to the centrum tendineum. Some of its fibers go circularly around the anus, some continue into the bulbocavernosus, some circle in the skin near the anal margin. The sphincter ani varies much in size in different women: it may be as thick as the little finger and as broad as the thumb-nail, or only half the size. This is true of all the perineal muscles.

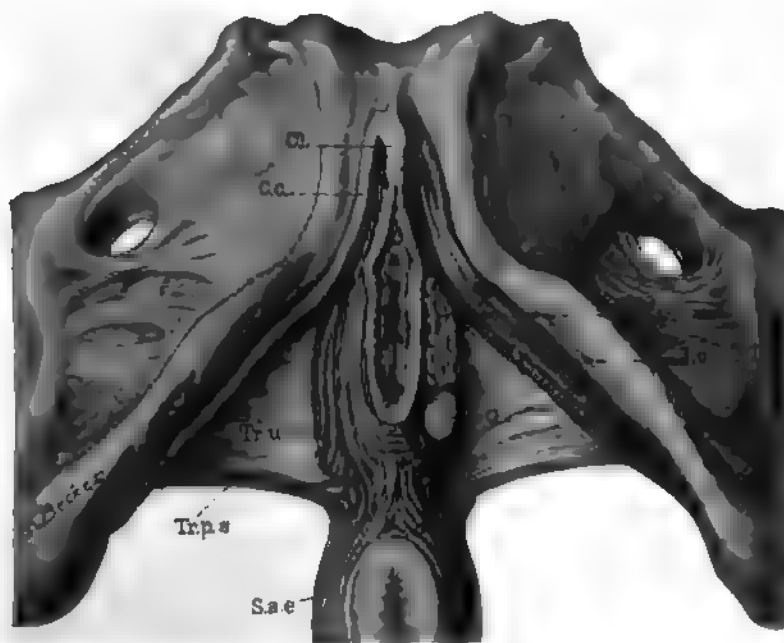


FIG. 184.—DIAPHRAGMA UROGENITALE.

Cl., Clitoris; C.c., crus clitoridis; Tr.u., trigonum urogenitale (triangular ligament); B.v., bulbus vestibuli; G., glandula vestibularis major (Bartholini); Tr.p.s., musculus transversus perinei superficialis; S.a.e., musculus sphincter ani externus; I.c., musculus ischioavernosus.

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#### THE FORMATION OF THE PARTURIENT CANAL

Before it can reach the external world, the child has to pass through three rings,—the cervix, the opening in the levator ani and the hiatus genitales, the vulva, and perineum. It is forced like a wedge against the resistance offered by these structures, and the overcoming of these structures is the main function of the powers of labor. Normally, the head is forced through the cervix before it comes down onto the pelvic floor. The dilatation of the diaphragma urogenitale occurs together with the diaphragma proprium, and together they are made to form a fibromuscular canal attached to the bony pelvic outlet. How the cervix is dilated until it is flush with the vagina has been described on p. 125. Fig. 185 shows the condition of the parturient canal at the time when, dilatation being complete, the fetal head has passed through the cervix and come to rest on the pelvic floor. Now the levator ani begins to stretch. It is displaced downward and backward with all the soft parts of the pelvic outlet; thus these structures suffer a displacement in an axial direction, in addition to being dilated radially. This lengthening of the soft parts is greater on the posterior wall than on the anterior, being only 2 or 3 cm. here,

while the posterior wall is stretched 10 cm. The bundles of the levator ani are separated and long drawn out (Figs. 186 and 187), so that they form, with the pubic arch, a canal whose circumference is equal to the head of the child—33 to 35 cm. The urogenital septum lies flat on the outside of the canal and dilates with it. Since the latter septum has little muscle, and connective tissue dilates poorly, it is the rule for tears to occur in this structure in all full-term labors. These tears allow a sagging of the anterior vaginal wall and urethra, producing the so-called "physiologic" prolapse of these structures. The sphincter ani is stretched from side to side as well as from before and backward. The anus, therefore, gapes widely as the head descends low, exposing the anterior wall of the rectum. The rectum is flattened out against the sacrum and levator ani. Owing to the attachment of the bladder to the lower part of the uterus it is drawn up into the abdominal cavity together with this portion of the retracting organ. Indeed, all the soft parts behind the pubis, the "pubic segment" (Barbour), have a tendency to retract upward, while those below, in front of the sacrum, the "sacral segment," are pushed downward. Hart and Barbour have likened this action to that of folding doors, one being pulled, the other being pushed, to allow an object to pass through them. The vagina is dilated radially and axially, to form a lining membrane for the canal.

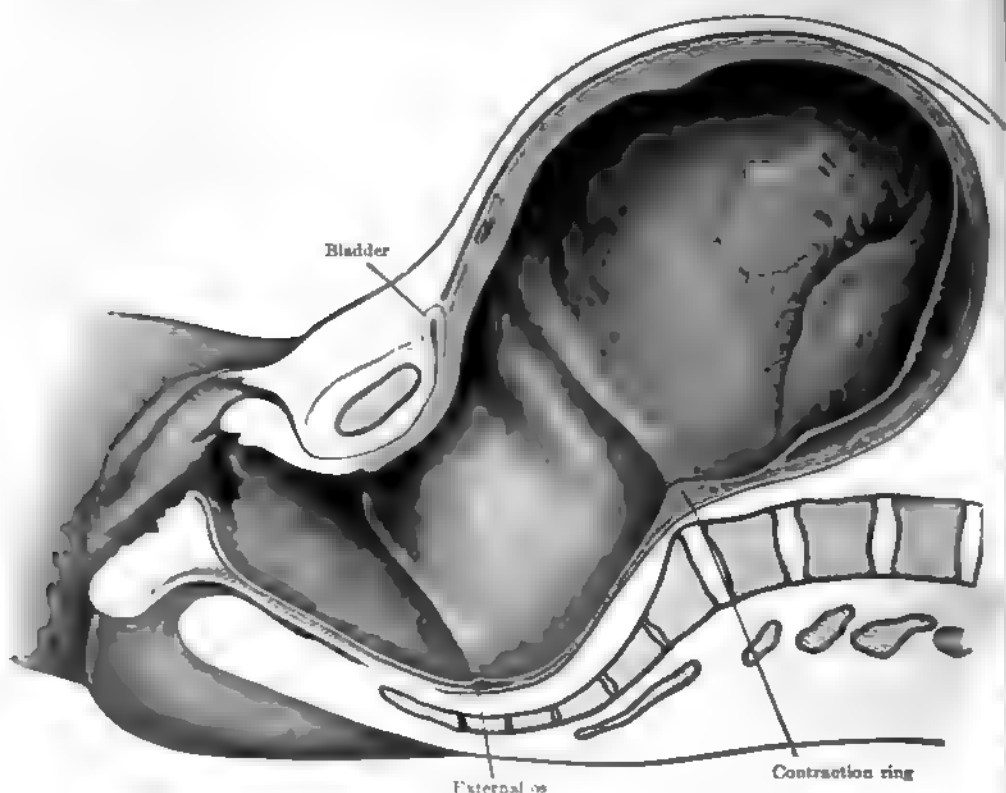


FIG. 185. BRACE'S FROZEN SECTION.  
The head has passed through the cervix and come to rest on the pelvic floor.

When the pelvic floor tears, the vagina usually does also, but it may not. These submucous lacerations of the levator ani are difficult to recognize and hard to repair.

We may show the shape of the parturient canal, as in Fig. 188, but the reader will understand that it exists as such, in its entirety, at no time during labor. The

advancing head produces such a disposition of the surrounding structures only at the moment it is passing through them. For the purpose of instruction, however, we may illustrate the completely dilated passages.

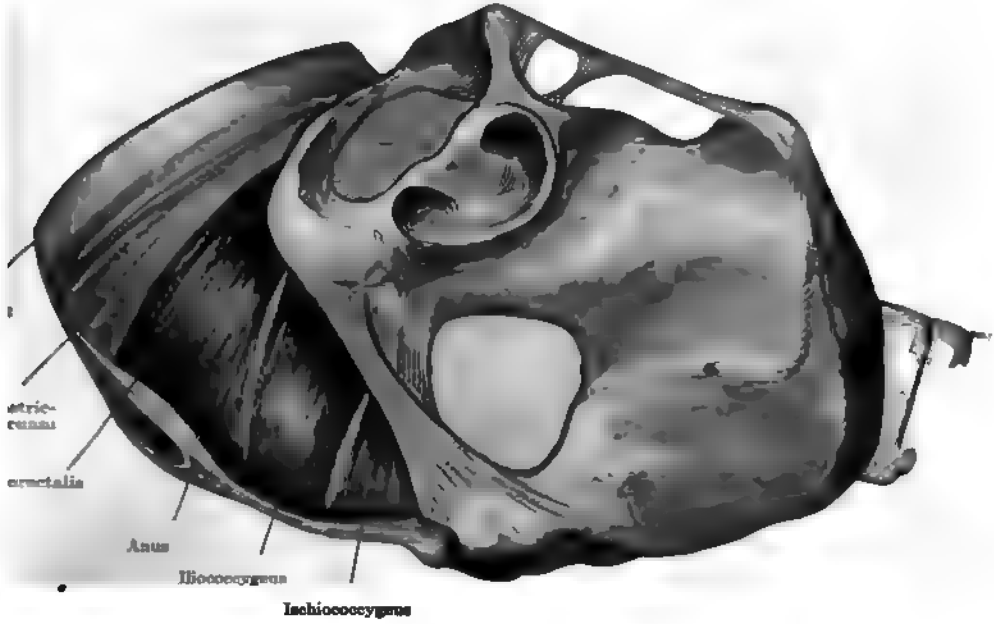


FIG. 156.—PELVIC DIAPHRAGM RECONSTRUCTED AFTER DELIVERY (drawn from Sellheim's model. Outside view).

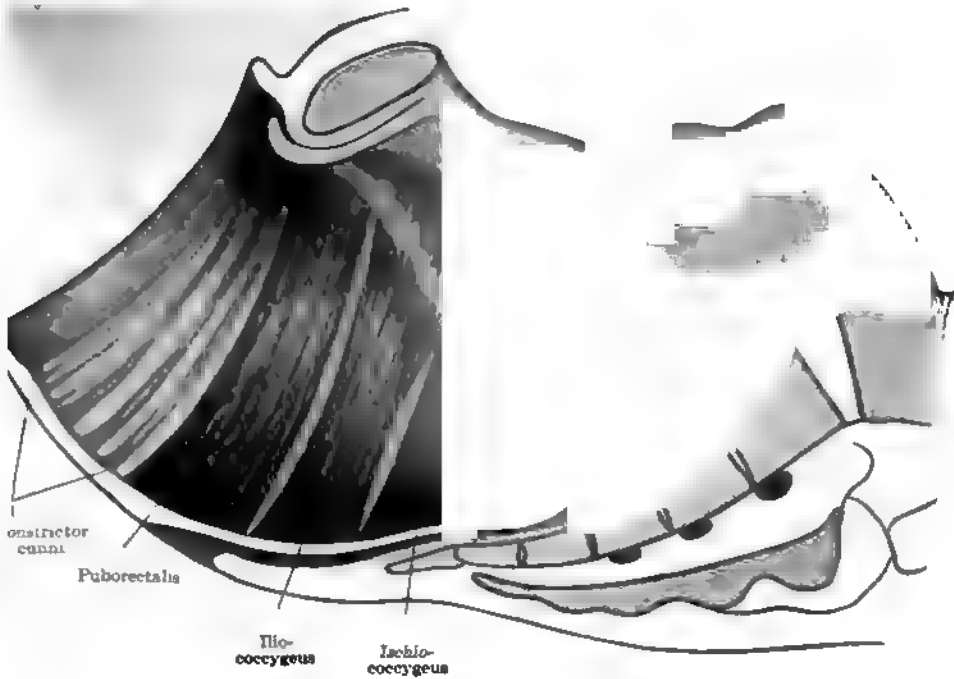


FIG. 157.—PELVIC DIAPHRAGM RECONSTRUCTED AFTER DELIVERY (drawn from Sellheim's model. Inside view).

Schröder divided the canal into a contractile and a dilating portion. All under the contraction ring or internal os dilates; the uterine muscle above it contracts. Since the vagina is fastened to the pelvic floor, contraction of the uterus stretches the canal from this point upward, and the advancing head pushes the tissues from this point downward. This axial stretching of the canal, if carried beyond the normal, may result in rupture of the uterus or vagina, and experience shows that this occurs most often in the zone extending from the internal os to the vagina. The radial stretching of the canal is greatest when the largest fetal plane is passing a given point. After this the elasticity of the walls of the canal adapts them to the reduced size of the fetal cylinder.

A study of the parturient canal will show that it runs straight down until it reaches the narrow pelvic plane or the third parallel of Hodge, then bends forward in a sharp curve whose center is the symphysis pubis. If the passage uses the space under the arch of the pubis, the bend in it is quite sharp. If the arch of the pubis is

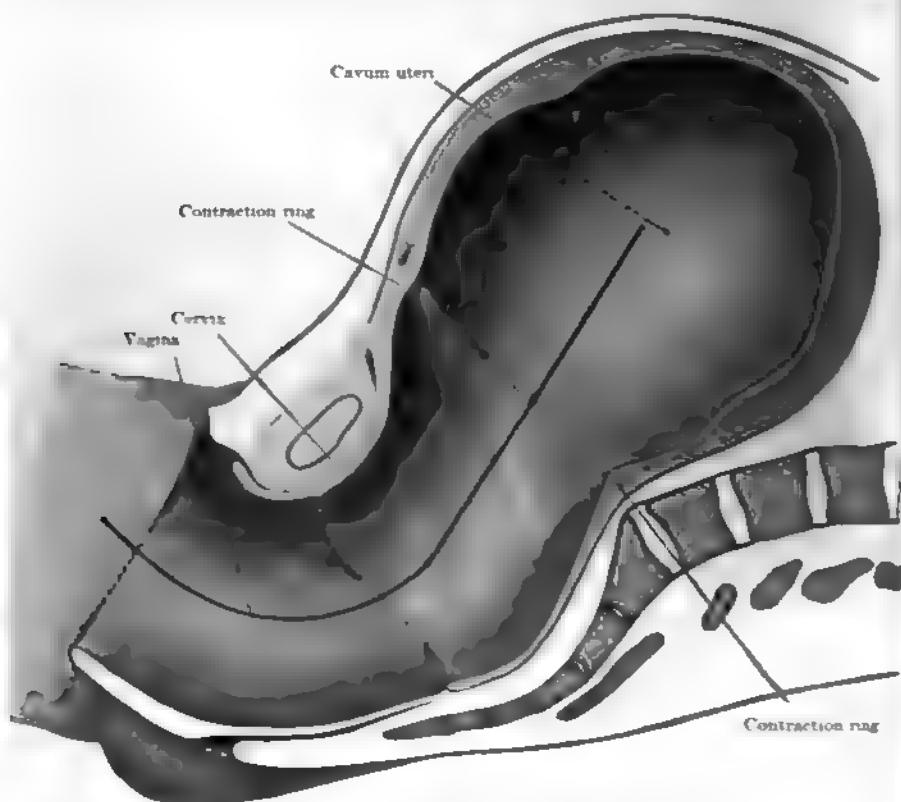


FIG. 188.—THE COMPLETED PARTURIENT CANAL.  
Black line indicates the axis of canal. Note sharp bend at narrow pelvic plane.

narrow, or if the fetal head is very large, the occiput stems on the rami pubis, forcing the pelvic floor further back toward the sacrum, making a more obtuse angle in the parturient canal. The axis of the parturient canal is, therefore, not a curve (the curve of Carus), but a straight line with a bend at the pelvic floor and a curve (Plate II).

A great deal, in normal as well as pathologic labor, depends on the curve of the sacrum and the angularity of the pubic arch. If the sacrum is sharply curved and the pubic arch broad, as in Figs. 189 and 189a, the bend of the parturient canal will be

PLATE II.



FROZEN SECTION (Bumm and Blumreich).  
Cervix is completely dilated. Note placenta on anterior wall and the formation of contraction rings to fit depressions in fetal cylinder



re sudden. If the sacrum is not so deeply curved and the pubic arch narrow, as Figs. 189b and c, the angle of the bend is very obtuse. Thus is created a factor

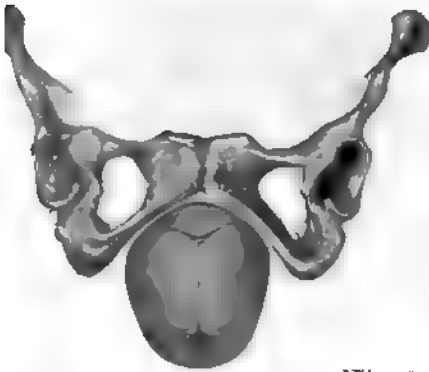


Fig. 189b.

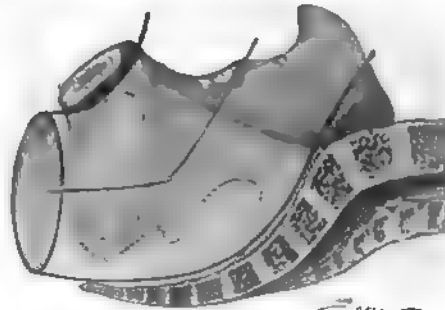


Fig. 189a.

FIGS. 189 AND 189a.—NORMAL SACRUM AND PELVIC OUTLET GIVING PROPER CURVE TO PARTURIENT CANAL.

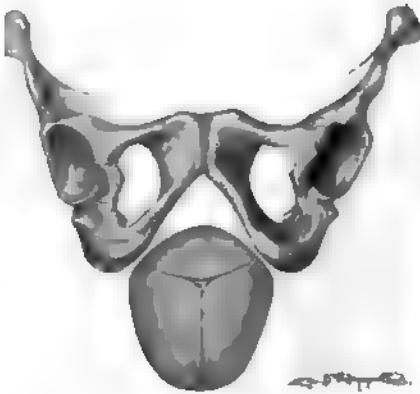


Fig. 189b.

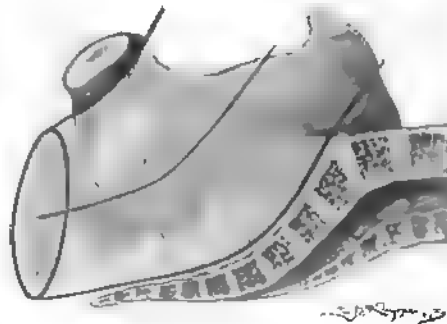


Fig. 189c.

189b AND 189c.—OBTUSE ANGLE GIVEN TO PARTURIENT CANAL BY ABNORMAL PELVIC CONFIGURATION. ROTATION OF HEAD MAY BE DELAYED IN THIS PELVIS.

be mechanism of labor which affects the movement of the fetus along the birth-al. (See p. 191.)

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## CHAPTER XI

### THE PASSENGERS

For the study of the mechanism of labor a consideration of the fetus as a mechanical object is essential,—more so than has generally been allowed—and we must consider its size, shape, compressibility, and pliability. The head is larger and more important, but the trunk takes no inconsiderable part in the normal mechanism of labor, and, when pathologically enlarged, may give rise to dystocia and even cause the death of mother or child or both. In the fetus the face is small, the vault of the cranium forming the major portion of the head. The four large squamous bones make up the cranial vault—the two parietal, the frontal and the occipital. At the sides the temporal bones unite with the parietals and provide for the molding necessary in the child's passage through the maternal

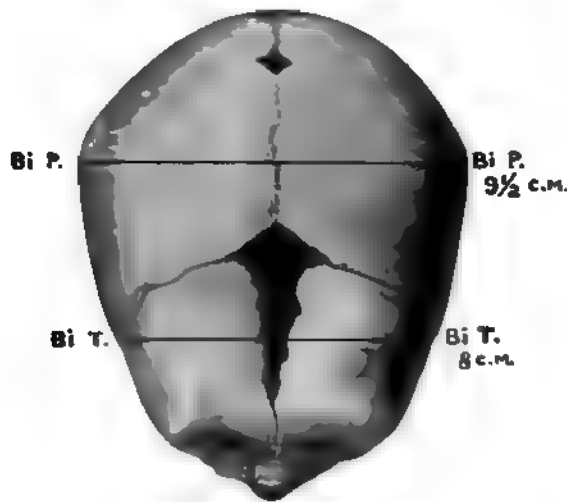


FIG. 190.—FETAL HEAD WITH DIAMETERS.

and for the rapid growth of the brain in the first year of life, these bones are not united, but the ossification halts at the lines of impingement, which later become the *sutures* of the skull. The bones are held together by the membrane in which ossification takes place—the chondrocranium. The lines of impingement are called *sutures*, and at the junctions of the sutures, owing to rounding of the corners of the separate bones, spaces filled by membrane are left, and these are termed *fontanelles* (fonticuli). Outside of the configurability conferred on the head by the sutures and fontanelles, these spaces are of vital importance to the midwifing accoucheur, for by means of them he determines the relation of the fetal head to the maternal pelvis, studies the mechanism of labor, and guides his application of obstetric forceps.

Between the two parietal bones lies the sagittal suture (Fig. 190); between the parietals and occipital, the bent lambdoid suture; between the frontal bone and the parietals, the coronary suture, while between the two plates of the front



tal suture, whose length varies. At the sides, where the parietal bones meet the temporals, lie the lateral or temporal sutures, of little obstetric importance. At the junction of the sagittal, frontal, and coronal sutures lies a lozenge-shaped space, the anterior or large fontanel. Its size depends on the degree of ossification of the abutting bones, and its shape also, since with advanced ossification it becomes more square. Four sutures run into the large fontanel, which fact distinguishes it from the others, and, of its angles, three are obtuse and one acute, which enables us to diagnose the position of the fetal head in the pelvis. The obtuse angle (Fig. 191) points toward the occiput, or posterior pole of the head, and the acute angle, toward the face.

At the junction of the sagittal suture with the lambdoid, a small triangular space exists, called the posterior or small fontanel. It is best to use the large and small fontanel to avoid confusion in the study of the mechanism of labor, since three sutures enter the small fontanel, which during labor is obliterated as

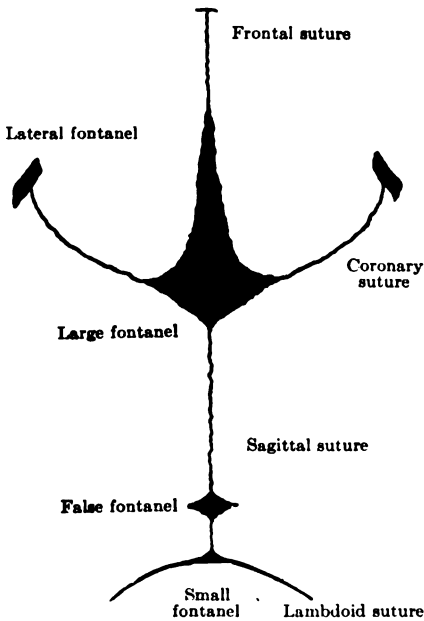


FIG. 191.—DIAGRAM OF THE SUTURES AND FONTANELS.

The three lines coming together at a point like the letter Y. The stem of the Y is the sagittal suture and runs toward the face.

Where the lateral sutures meet the ends of the coronary and lambdoid, spaces are called the lateral fontanelles. They are important because they may be mistaken for the other fontanelles and lead to costly diagnostic errors. The ear is close to the anterior lateral fontanel, the bony orbit next to the anterior, and hereby they are readily avoided. Wormian bones are accessory centers of ossification which sometimes occupy the spaces of the fontanelles, but they have no obstetric importance. In the sagittal suture occasionally a quadrangular space is found which is most easily mistaken for the large fontanel, and may cause serious diagnostic errors. It is a false fontanel. Confusion may be avoided by following the sagittal suture to its terminal fontanel.

To distinguish the regions of the skull by particular names. The occiput is the posterior part (Fig. 192) lying behind the small fontanel; the sinciput is that portion

lying anterior to the large fontanel; the bregma, the region of the large fontanel at the vertex, the region between the two fontanels and extending to the parietal tubercles. In shape the fetal head is irregularly ovoid—narrow in front, broad behind. The frontal bone is quite square, the result of the angularity of the frontal protuberances, and the parietal bones have on each side a prominence well marked—more or less sharp—the parietal bosses (*tubera parietalia*). They mark the points where the head meets the greatest resistance in passing through the pelvic inlet. Inference may be made regarding the shape of the child's head by considering the shape of its parents because it may resemble either one; usually, however, the mother's shape makes the greater impress. Certain vagaries have been noted in the ossification of the sutures, which give the skull peculiar shapes. If the sagittal suture unites early, a scaphocephalus results: the head is boat-shaped, being as broad in front as behind. If the frontal suture ossifies early, a three-cornered head results: a trigonocephalus. In similar ways brachycephalus—short head—and dolichocephalus—long head—are produced. These various shapes modify the mechanism of labor and may produce dystocia.

The fetal head diameters vary quite a little within normal limits. The measurements of the head by labor shortens some diameters and lengthens others. The measurements, therefore, should be taken a second time four or five days after birth, when the head has recovered its original shape. The measurements here given are averages of a large number of children (Jaggard).

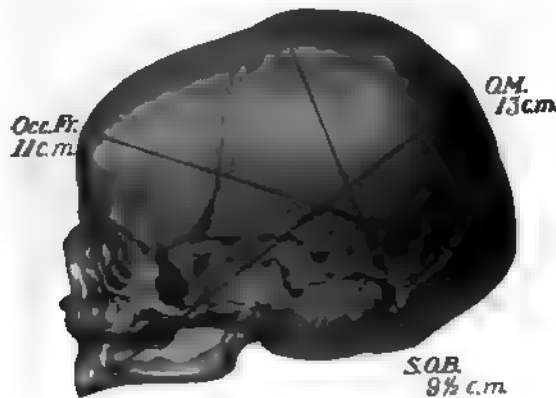


FIG. 192.—SIDE VIEW OF FETAL SKULL.

Diameter biparietalis—B.P., 9½ cm.  
 Diameter bitemporalis—Bi.T., 8 cm.  
 Diameter suboccipitobregmaticus—S.O.B., 9½ cm.  
 Diameter occipitofrontalis—O.F., 11 cm.  
 Diameter occipitotemporalis—O.T., 9 cm.  
 Diameter occipitomeatalis—O.M., 13 cm.

There are many other diameters, but these are the only ones practically necessary. Two circumferences of the head should be taken, the large and the small. The first taken around the occipitofrontal diameter, the other around the suboccipitobregmatic. They measure 34 and 31 cm. respectively.

The trunk, while apparently larger, presents smaller diameters to the pelvis, because it may be compressed to assume cylindric proportions. In children the shoulders are very broad, in others relatively much smaller than the head. Boys usually have larger heads at birth, and this is also true of the trunk, regardless of sex. The bisacromial diameter of the fetus is 11 cm.; the pelvic diameter is 10 cm. The circumference of the shoulders is 34 cm.; of the chest, 32 cm.

By "attitude" is meant the relation of the various parts of the fetal body to each other. The normal attitude of the child, when there is no scarcity of liquor

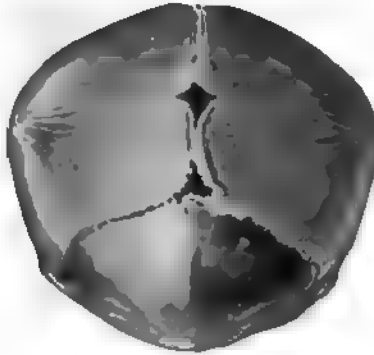


FIG. 193.—BACK VIEW OF FETAL SKULL.  
Shows small fontanel and a "false" fontanel.

amni, is one of flexion of all the joints, head slightly bent on the chest, arms on the chest, legs on the thighs, thighs on the abdomen, and the back of the child is curved.



FIG. 194.—POSTURE OF CHILD IN UTERO.  
Shows interflexion of trunk.

the ears, the clavicles standing almost vertically, a fact easily proved by examination after the head is delivered. This action fixes the head on the trunk, so there is only one direction in which the head can bend readily, and that is extension. The effect of such a condition on the mechanism of labor will be studied hereafter.

Dehling proved that the size of the head can be slightly reduced under the pressure of labor by the escape of cerebral fluid into the spinal canal. Perhaps, too, some of the blood in the brain may escape into the cervical veins. It is questionable, however, if such a small reduction as is thus possible is of any real influence in the mechanism of labor. The configurability of the skull, on the other hand, is of utmost importance. Figs. 162, 163, and 164 show how the head is molded in the common delivery. When the child comes in face presentation, other cranial deformations are produced. The circular pressure of the uterus forces all the fetal tissues into conformation with the cylindric bore of the birth-canal, and one thus finds cross-sections of the fetal ellipsoid to show almost circular outlines. The reduction of the oblique diameter may be as much as 2 cm., depending on the hardness of the tissues. If the child is overgrown, it is poor in water, and the flesh is tougher and less compressible. Dystocia is common in these cases.

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Atlas of the Anatomy of Labor, Plate 22.—*Sellheim: Geburtskanal und Geburtsobjekt*, Thieme, Leipzig, 1906.

#### PRESENTATIONS AND POSITIONS

Authors are not in accord in classifying the various ways in which the fetus presents itself for delivery. Baudelocque (1775) described 94 presentations. At any portion of the child's person can present itself first for delivery, since the attitude and position of the child change during labor, the difficulties in way of a universally acceptable classification are apparent. That accepted at the Ninth International Medical Congress at Washington, 1887, is generally recognized.

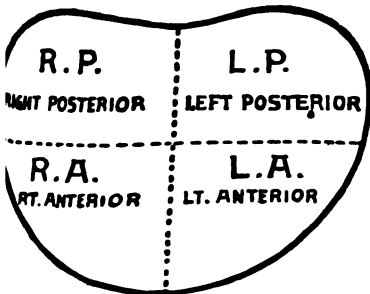


FIG. 196a.—THE FOUR QUADRANTS OF THE PELVIS. Looked at from above.

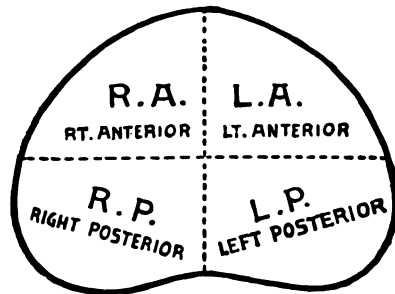


FIG. 196b.—THE FOUR QUADRANTS OF THE PELVIS. Looked at from below.

is the best, but it is not complete enough. In the terminology, that adopted at the Basle Congress has been employed.

**Definitions.**—By “presentation” is meant that portion of the fetus which is felt by the examining finger through the cervix, or, during labor, is bounded by the resistance. According to Hodge, it is that part felt by the examiner “toward the center of the pelvis.” Much confusion will be avoided if the term “presentation” is adopted as here defined, and made synonymous with the expression “presenting part.”

**Position** is the situation of the child in the pelvis, and is determined by the relation of a given, arbitrary point in the presenting part to the periphery of the pelvis.

"*The point of direction*" is this arbitrary point in the presenting part, by which we determine the topographic relation of the presenting part to the periphery of the pelvic planes, i. e., its position. In occipital presentation the occiput is the point of direction; in breech presentation, the sacrum; in shoulder presentation the scapula; in face, the chin, etc. The Germans use the back as the point of direction.

"*Attitude*" is the relation of the fetal members to each other: it is habitus. The attitude of the fetus has much to do with its presentation, but they are not identical. Attitude may be disturbed by the arms leaving the chest,

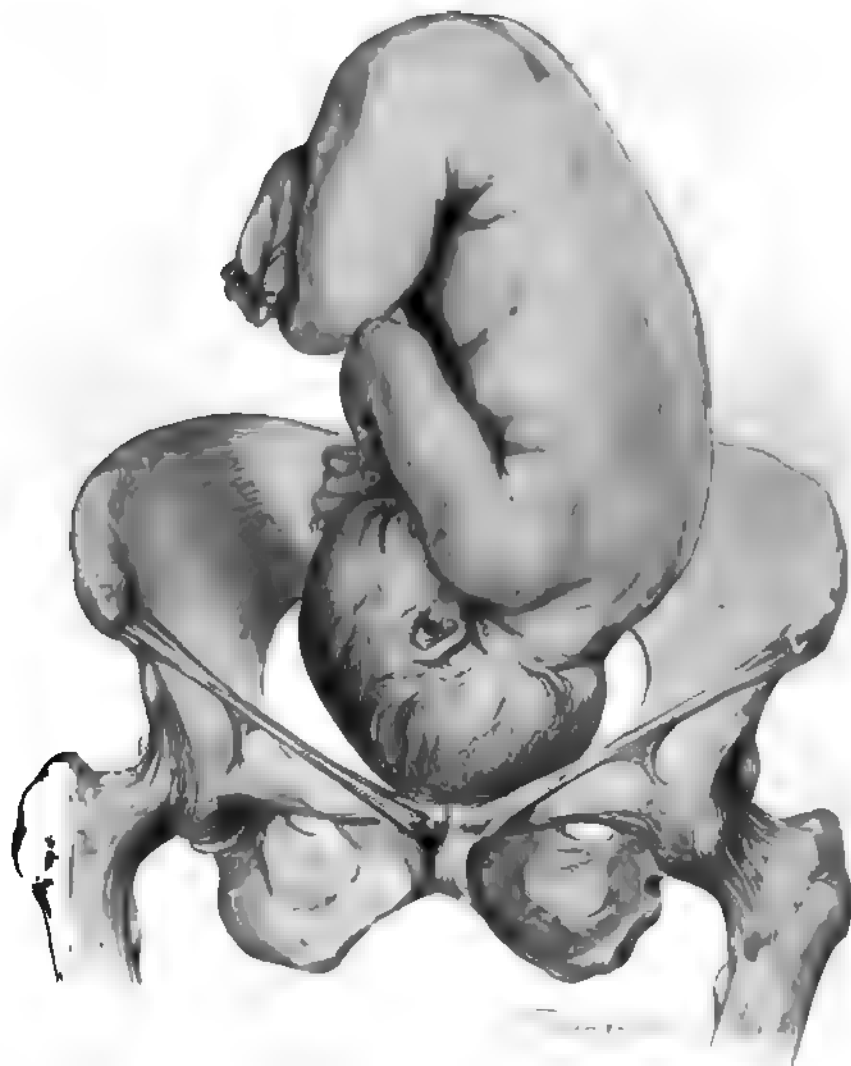


FIG. 197.—O.L.A.

legs leaving the abdomen and prolapsing, or the cord prolapsing, the chin extending, making the various deflexion presentations, etc.

All terms as to direction are referred to the mother in the erect position. The term *upper* means the part in the direction of the fundus uteri; *lower*, the part nearer the vulva; *anterior*, means the direction to the front of the mother; *posterior*, the direction to the back of the mother.

right side of the mother, etc.—these terms having no application to the child the examiner. By keeping this rule in mind, confusion will be avoided.

For convenience of description the pelvis is divided into four quadrants— anterior left, an anterior right, a posterior right and left (Fig. 196). The position of the presenting part is defined according to that quadrant in which the point of direction lies. Three grand divisions of presentation are recognized:

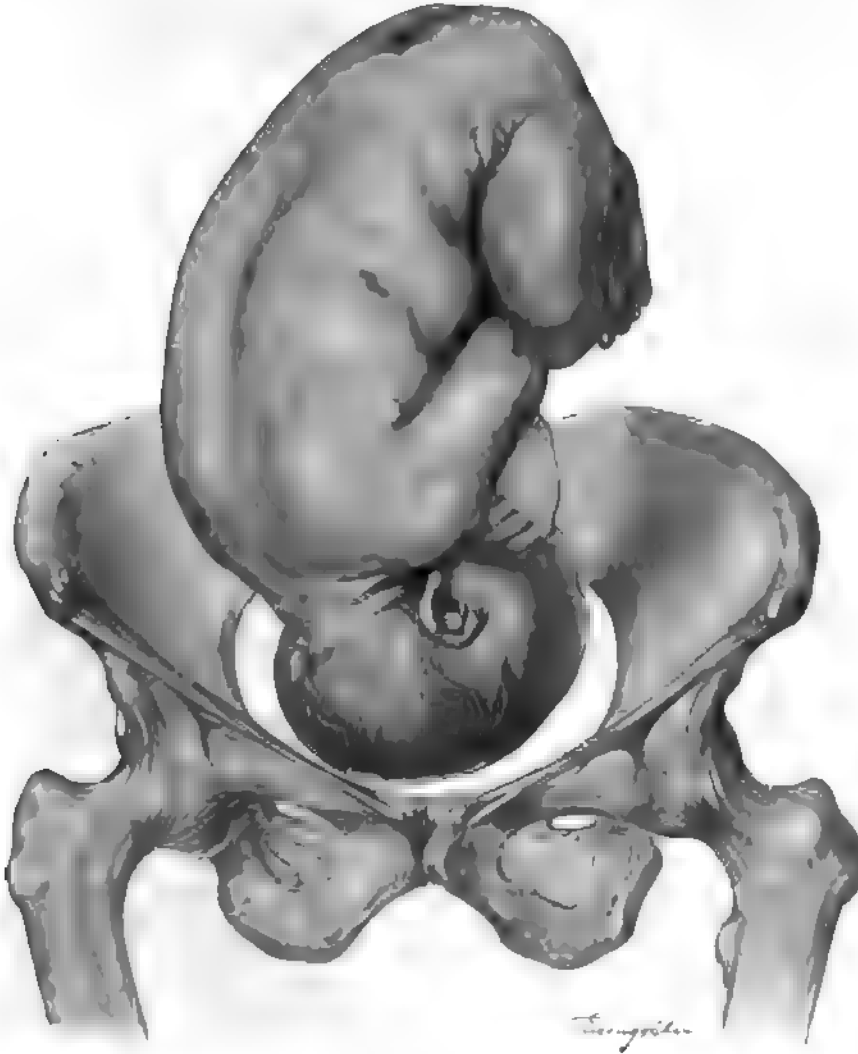


FIG. 198.—O.D.A.

- I. Cephalic presentation and its varieties—vertex, breech, brow, and face. The vertex is the normal, the others are transitional, or pathologic, being due to deflexion of the head. They are sometimes called "deflexion attitudes."
- II. Pelvic or breech presentation and its varieties—complete breech, footling, double footling, knee, double knee, and single breech.
- III. Transverse presentation, including shoulder, arm, and any part of the trunk.

In the first two groups the axis of the fetus lies parallel with that of the uterus; in the last group it lies obliquely, more or less.

Presentation has to do with the part of the fetus which presents itself to the parturient passage first for delivery. It is determined by the attitude of the child and the relation of its axis to that of the birth-canal. Position, in its technical sense, means the topographic relation of the presenting part to the plane of the pelvis in which it lies; that is, to the four quadrants of the pelvis. Each presenting part



FIG. 199.—O.D.P.

may so occupy the pelvis that its point of direction may lie in any pelvic diameter for example, the occiput may be to the right, to the left, behind, in front, or at any intermediate point, when labor begins. The most common locations are used for teaching. The Committee at Washington adopted four main positions. Six are here given, and other writers (Williams, Farabeuf and Varnier) also distinguish them. The Latin terms and abbreviations are to be preferred. In the following table the positions are named about in the order of frequency:

## CEPHALIC PRESENTATIONS

## 1. Vertex—occiput, the point of direction.

Occipito-læva anterior . . . . .	O.L.A.
“ læva transversa . . . . .	O.L.T.
“ dextra posterior . . . . .	O.D.P.
“ dextra transversa . . . . .	O.D.T.
“ dextra anterior . . . . .	O.D.A.
“ læva posterior . . . . .	O.D.P.

## 2. Face—chin, the point of direction.

Mento-dextra posterior . . . . .	M.D.P.
“ læva anterior . . . . .	M.L.A.
“ dextra transversa . . . . .	M.D.T.
“ dextra anterior . . . . .	M.D.A.
“ læva transversa . . . . .	M.L.T.
“ læva posterior . . . . .	M.L.P.

## 3. Brow—the brow the point of direction.

Fronto-dextra posterior . . . . .	F.D.P.
“ læva anterior . . . . .	F.L.A.
“ dextra transversa . . . . .	F.D.T.
“ dextra anterior . . . . .	F.D.A.
“ læva transversa . . . . .	F.L.T.
“ læva posterior . . . . .	F.L.P.

## PELVIC OR BREECH PRESENTATIONS

## 1. Complete Breech—the sacrum the point of direction (feet crossed and thighs flexed on belly).

Sacro-læva anterior . . . . .	S.L.A.
“ læva transversa . . . . .	S.L.T.
“ dextra posterior . . . . .	S.D.P.
“ dextra anterior . . . . .	S.D.A.
“ dextra transversa . . . . .	S.D.T.
“ læva posterior . . . . .	S.L.P.

When the breech is incomplete,—that is, when one or both feet have been proed, or one or both knees are down, or when the feet are turned upward along chest, so-called single breech,—the sacrum is still the point of direction, the gnations remaining as above, and one simply adds the qualification, footling, e, etc.

## TRANSVERSE PRESENTATIONS

## 1. Shoulder—the scapula being the point of direction.

Scapulo-læva anterior . . . . .	Sc.L.A.	{ Back, ante- rior positions
“ dextra anterior . . . . .	Sc.D.A.	
“ dextra posterior . . . . .	Sc.D.P.	
“ læva posterior . . . . .	Sc.L.P.	{ Back, poste- rior positions

The back, side, or belly may present, but these are rare, and come readily under the above classification.

One important dimension is lacking in this presentment. How are we to determine the distance the fetus has advanced down the birth-canal toward the vulvar let? How shall we convey the idea of the location or degree of progression of



the presenting part in the birth-canal? Müller suggested the word "station" or "statio," and used it thus, for example, "statio in aditu," presenting part in the inlet, "statio in exitu," at the outlet. Bacon is the only American teacher who has adopted this form. Location would be a better word. The term "degree of engagement" was used by Jaggard and is often employed, and the entry of the head into the pelvis he called "engagement."

A head is "not engaged" when its greatest transverse diameter is still above the plane of the inlet. If freely movable, we call it "floating," or "caput ballitabile."



FIG. 200.—O.L.P.

A head is fixed on the inlet or "engaging" when the largest transverse diameter is just about to pass the inlet—"caput mobile." A head is "engaged" when the largest transverse diameter has passed the plane of the inlet—"caput ponderosum." A head is "deeply engaged" when the largest diameter lies in the narrow pelvic plane. A head is "at the outlet" when the largest diameter is passing the bony outlet. The perineum is beginning to bulge at this time. A head is "on the perineum" when the largest diameter has passed the bony outlet and the head begins to show in the vulva. This might be called the period of *disengagement*.

A diagnosis of the mechanical conditions of a given labor, therefore, requires a statement of the presentation, the position of the presentation, and the location or degree of engagement of the presenting part. The last is of great importance, but much neglected, and often with fatal results to mother and child.

#### LITERATURE

Müller: *Monatsschr. f. Geb. u. Gyn.*, vol. xvi, p. 848.—Williams, Farabeuf and Varnier: Text-books.

#### FREQUENCY OF THE PRESENTATIONS AND POSITIONS

Karl Braun, in 48,449 cases, found vertex presentations in 95.9 per cent.; pelvic presentations, 2.7 per cent.; face, 0.6 per cent.; transverse, 0.7 per cent. Of the other presentations, 70 per cent. were O.L.A., 29 per cent. O.D.P., and 1 per cent. the other two positions. Schröder, from a clinical study of over 250,000 cases, finds the vertex in 95 per cent.; breech in 3.11 per cent.; the face, 0.6 per cent.; and transverse presentations in 0.56 per cent. Much labor has been spent in compiling these statistics, but their value is not great, because everything depends on the time when the diagnosis is made. During the last few weeks of pregnancy both the presentation and the position of the fetus may change, Schröder claiming this to occur in 32 per cent. of the cases. The most frequent changes are breech and boulder, to head. Ordinarily the presentation is permanent after the presenting part has engaged in the pelvis, but this is not invariable. The author has observed a head which had sunk deep into the excavation rise up into the abdomen again before labor set in. Hippocrates believed that at the seventh month the child, which up to then presented by the breech, turned a somersault (variously named, *Calbute*, *Inversio Fetus*—*Peristrophe*) and the head came over the inlet.

While changes of the long axis of the child are not infrequent, changes in position are of almost daily occurrence. Examination of the woman on successive days, in the morning and evening, will show the back now on one side, now on the other. Multiparae, because of the lax uterine and abdominal walls, show the most marked mobility of the fetus. During labor the fetus may also alter its presentation and position, particularly the latter. If the observer happens to examine the patient early in labor, he may find an O.L.P.; if a few hours later, an O.L.T., and again later an O.L.A., or even an O.D.A. Hospital statistics differ from those in private practice because pathologic labors are sent to hospitals. Figures from the one source show a large percentage of abnormal presentations; from the other, a necessarily smaller percentage. The effect of all these factors on the value of our statistical information is evident.

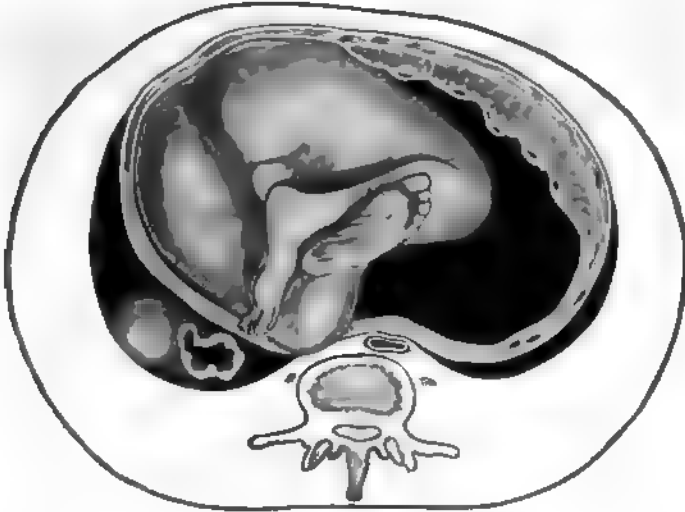
During pregnancy the child is more movable and accommodates itself to the varying position of the mother. When she is erect, its back falls forward; when on the side, it drops to the side on which she lies. This explains the frequency of O.L.T., O.D.T., O.D.P., and O.L.P. in our routine pregnancy examinations. One examiner may diagnose O.D.A., and his follower O.D.P., the change having resulted from the prolonged dorsal position of the mother and displacement by the palpating hand.

**Causes of the Frequency of the Cephalic Presentations.**—Hippocrates believed gravitation explained the predominance of head presentation. The heavier head sinks to the lowest part of the uterus. This idea was held until very recently, when it was shown that the head is very little, if any, heavier than the breech, and that the conditions of the uterine cavity are such that any movement, the result of difference in weight, would be more than nullified by the friction of the fetus on the uterine wall. Dubois believed the fetus instinctively sought that position which was most comfortable; Simpson referred the head presentation to the reflex movements of the child when it was forced out of the position in which it could be most easily accommodated. Cohnstein gives the older theories in full.

The law of accommodation of Pajot explains it best. Where an ovoid body is free in an ovoid container, the two long axes tend to become parallel, which is

in child. Hydrocephalic children and anencephali predispose to breech presentation. Accident is a factor, as when labor begins suddenly or the bag of waters ruptures when the fetus is in an unfavorable presentation.

Abnormalities in the shape of the uterus cause malpresentations. Uterus atretus and bicornate uterus are often attended with breech or shoulder presentation.



331.—SHOWING EFFECT OF PROJECTION OF LUMBAR SPINE, AND ALSO OF THE LOCATION OF PLACENTA ON ANTERIOR UTERINE WALL. O.L.A.

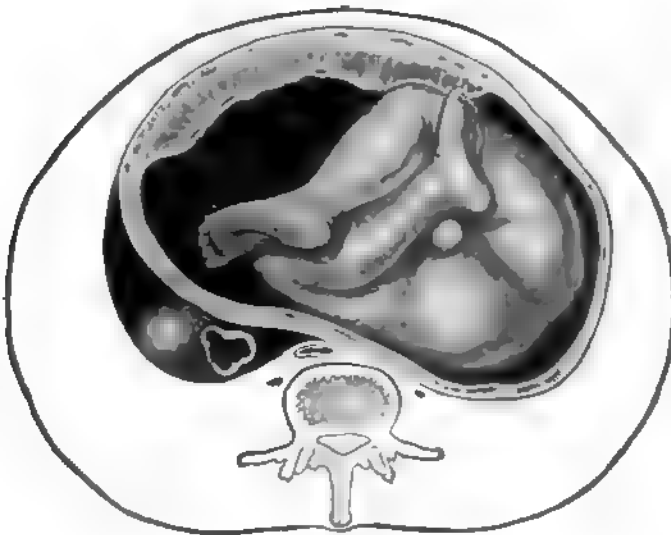


FIG. 205.—O.D.P.

In one such case the author delivered two breech presentations, and in her the sixth successive footling.

Contracted pelvis, tumors of the lower uterus or pelvis, placenta prævia,—in all conditions which prevent the engagement of the head,—predispose to shoulder and breech presentations.

#### LITERATURE

1. "Die Ätiologie der normalen Kindeslagen," *Monatsschr. f. Geburtsh.*, 1868, vol. xxi, p. 141.—*Schatz*: *Arch. für Gyn.*, 1916, 105, T. 121.—*Schröder*: *Lehrbuch d. Geburtshilfe*, p. 130.—*Seitz*: *Handbuch d. Geb.*, vol. i, 2, p. 1024.

## CHAPTER XII

### THE MECHANISM OF LABOR IN OCCIPITAL PRESENTATION

ALTHOUGH the movements imparted to the child by the powers of labor were known to the older writers, Baudelocque, Smellie, and others, and Naegelè, in 1819, described them minutely, opinion is still divided as to their causes. If the student wishes to study these movements, a multipara will offer better advantages than a primipara, because, in the latter, the head is already engaged when labor begins. The demands of asepsis restrict the frequent examination of the parturient which is necessary for a minute study of the mechanism. The use of sterile rubber gloves

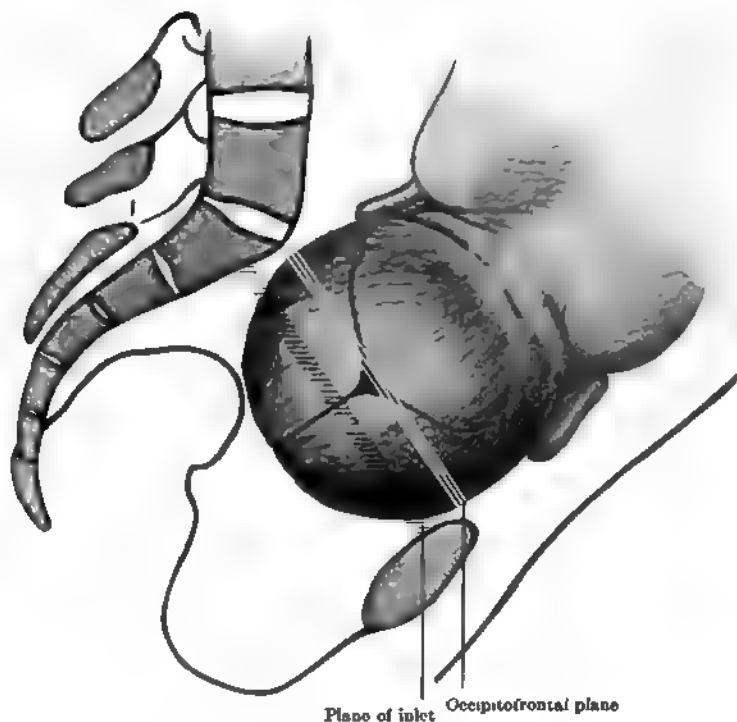


FIG 206.—SYNCLITISM OR PARALLELISM.

and extreme antiseptic precautions will reduce the danger of infection, and a few thorough examinations will give the student a great deal of information.

Broadly, the mechanism of delivery is as follows: An object consisting of two ovoids united by a hinge (*i. e.*, the head and trunk united by the neck) is to be forced through a passage, straight at the beginning and sharply curved at its lower end. We must consider the manner of passage of the head and of the trunk. Each makes three movements—*engagement*, or entry into the pelvis; *rotation*, or adaptation to the shape of the pelvis, and *disengagement*, or exit from the pelvis.

**Engagement of the Head.**—*Multipara, O.L.A.*—At the beginning of labor the head lies over the inlet, inclined but little on either shoulder. The sagittal

re lies about midway between the promontory and the pubis—perhaps a little nearer the pubis if the promontory juts sharply forward. The head is then said to be mesolitic or in synclitism (Fig. 206). The occipitofrontal plane lies parallel to the plane of the inlet. If the woman has a pendulous belly, being a multipara, or if the pelvis is contracted, preventing a normal mechanism, the body of the fetus is pushed forward, the sagittal suture nears the promontory, the head presents its anterior parietal bone to the parturient canal, the parallelism between the occipitofrontal plane of the head and the plane of the inlet is destroyed, the head is asymclitic—it is in anterior asymclitism. This is often called Nægelè's obliquity (Fig. 207).

If the woman is a primipara, the abdominal walls holding the child firmly against the spine, the head may be inclined on the inlet with the posterior parietal bone more to the front, again disturbing the parallelism. This is posterior asym-

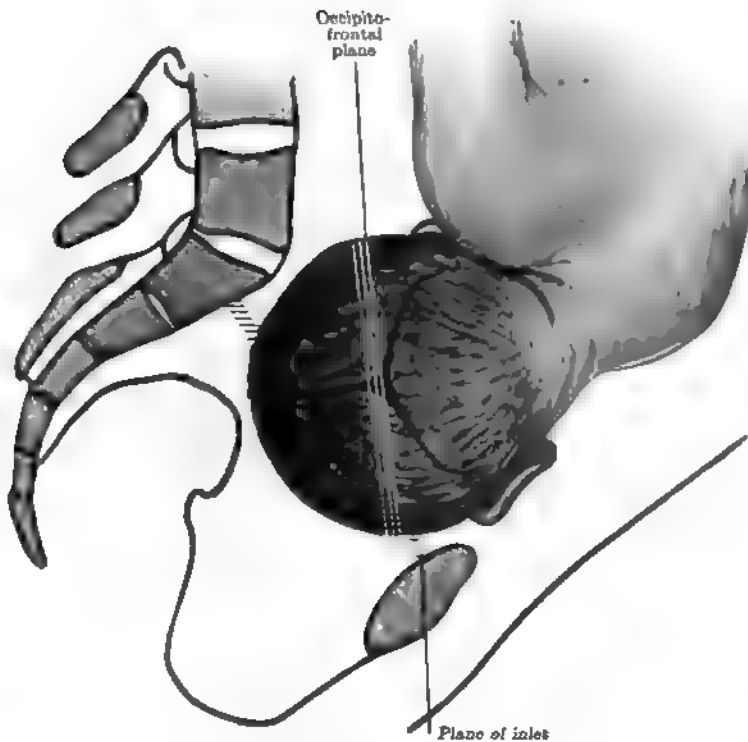


FIG. 207.—ANTERIOR ASYNCLITISM (Nægelè's Obliquity).

clitism (Fig. 208). Nægelè believed the head usually entered the pelvis in anterior mesolitic, but extended investigation has disproved this view. The author has actually found the sagittal suture about midway between the promontory and the pubis. Marked asymclitism is pathologic. (See p. 710.) The sagittal suture also usually runs transversely across the pelvis, and, in a multipara, one finds the small and the large fontanels in the same plane of the pelvis. The head, therefore, usually enters the inlet with its long diameter in the transverse of the pelvis; and since the fontanels are about as easily reached by the examining finger, we conclude that the head is not strongly flexed on the chest. Many authors dispute the former of these statements, claiming that the head enters the pelvis in one of its oblique diameters, especially the right, but the author, after careful study of hundreds of cases, believes the head enters transversely in the majority of cases. Nægelè believed it entered either in the oblique or in the transverse. Sir Fielding Ould, of

Dublin, corrected the ancient notion that the head entered the inlet with occiput to the pubis. Pathologically it may do so.

*Descent.*—As soon as the uterine contractions begin, general intra-uterine pressure tends to force the fetus downward, and when the os is completely dilated, *descent* begins. Descent of the head is also favored by the extension of the body. (See p. 176.)

One result of descent is an increase of the *flexion* of the head. Mechanically the head acts like a two-armed lever, with the fulcrum at the junction of the neck with the occipital condyles. The sinciput and occiput meet equal resistance in the birth-canal, but the sincipital end of the head lever is longer than the occipital end, wherefore the sinciput is held back and the occiput descends. Any ell

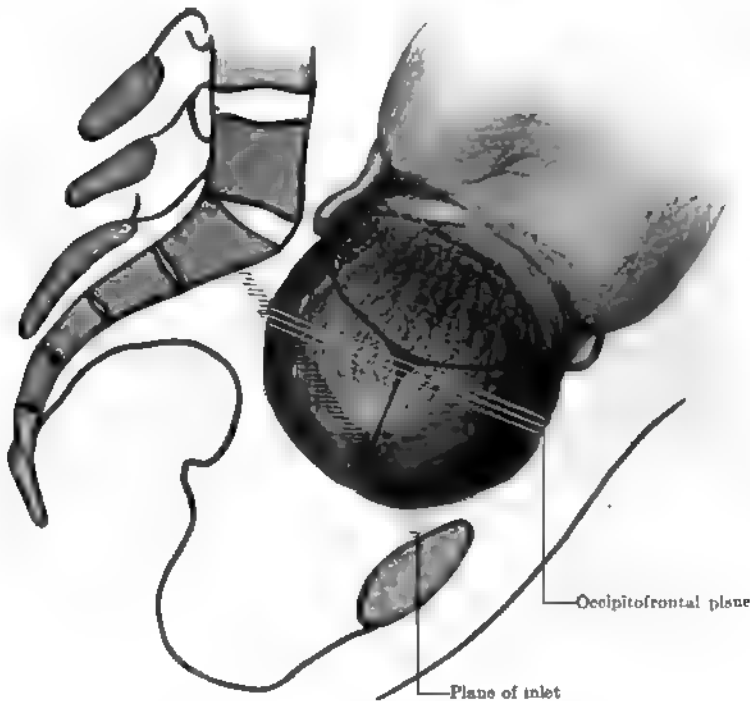


FIG. 208.—POSTERIOR ASYNCLITISM (LITZMANN'S OBLIQUITY)

body passing through a canal, in order to avoid resistance, will adapt its axis to the long axis of the canal. The mechanical gain in flexion is that instead of an occipitofrontal diameter of 12 cm. and a circumference of 35 cm., is presented to the birth-canal the suboccipitobregmatic plane with a diameter of 9 cm. and a circumference of 31 cm. Flexion may be marked, as occurs in general contracted pelvises. It may not occur until the head is well down on the pelvic floor and thus labor may be delayed. Another result of descent and flexion is the appearance of asynclitism, that is, the parallelism is restored, "leveling" the sagittal suture approaches the middle of the pelvis (Fig. 209).

In pathologic cases the asynclitism persists after engagement and may interfere with the next movement, rotation. Descent of the head into the pelvis, or engagement, is one of the most important phenomena of labor presented to the accoucheur for study, and clinically its importance is vital. A head is engaged in the pelvis when the biparietal diameter has passed the region of the inlet.

*Internal Rotation.*—The lowest part of the head now nears the pelvic floor

movement is imparted to it. The occiput rotates from the transverse diameter into the oblique, and, finally, anteroposteriorly. This movement is called *anterior rotation*, and many theories are advanced to explain it. One of the oldest notions was that the pelvis presented a long transverse diameter in the inlet and a long sagittal diameter at the outlet, and that the head had to seek these diameters in its passage. This is only partly true. If one looks into a pelvis from above, one will see the spines of the ischia projecting sharply into its lumen. The sides of the pelvis anterior to the spines curve gracefully downward, forward, and inward. A finger following the curve glides gently forward under the pubis. Without doubt this portion of the bone forming a part of the lateral inclined planes, important to Hodge, has some slight function in anterior rotation. Its action



FIG. 209.—THE SYNCLITIC MOVEMENT, OR LEVELING.

as opposite, together with the levator ani, may be likened to the ways of a goat. The levator ani hangs like a sling, or trough or gutter, from the sides of the pubis and the ischia (which form the anterior lateral inclined planes), with the action of its canal from behind forward. The occiput, sliding down the side of the pelvis, is directed under the pubis, the long diameter of the head accommodating itself to the length of the trough, according to the law of inclined planes. As the occiput is almost always lower than the sinciput, it strikes the pelvic floor first, and, therefore, has the greater tendency to rotate anteriorly under the action of the pelvic floor (Fig. 210). Examination at this period of labor will demonstrate the action of the pelvic floor in rotating the head forward. Experiment—forcing the head into the pelvis of a female cadaver—shows that, as long as the integrity of the pelvic floor is preserved, its action is to force the occiput forward (Fig. 211). In

women with old lacerations of the pelvic floor anterior rotation is often delayed or absent. When the sacrum is insufficiently curved, and the pubic arch very narrow, the trough or gutter is not sufficiently sharply bent on the axis of the parturient



FIG. 210.—HEAD COMING DOWN ONTO LEVATOR ANI.  
Note lateriflexion of head and twisting of body.



FIG. 211.—ANTERIOR ROTATION COMPLETED.  
Head on the levator ani. Note lateriflexion is corrected. Body still twisted.



nal to favor anterior rotation, which, therefore, is often arrested—a pathologic condition called “deep transverse arrest” (see Figs. 193 and 194).

Schröder and Olshausen believed that the rotation of the back is communicated to the head. When the uterus contracts in the second stage it flattens from side to side, and the trunk of the child finds better lodgment in the anterior belly of the uterus. That the back rotates to the front is easily demonstrable in most cases. The flexion of the chin on the sternum and the raising of the shoulders against the head tend to fix the head and trunk so that when the back turns, the head goes with it. One may easily convince himself of this by making the movement with a new-born infant. After the head has rotated and is deep in the pelvis, the back does not follow it fully, remaining behind about 30 degrees (Schatz). In cases where the back remains persistently behind, anterior rotation does not occur, and such conditions are pathologic. In manual correction of occipitoposterior positions the operator knows that unless he can get the back to the front, rotation of the head is incomplete or impossible or unstable.

Sellheim, in most elaborate fashion, proves that the body of the child possesses qualities which determine its movements in the birth-canal. As was described before, the child during labor, in order to present the least resistance to the birth-canal, is compressed into the shape of a cylinder. This fetal cylinder bends with facility only in certain directions. The head bends backward, i. e., deflexes easily,

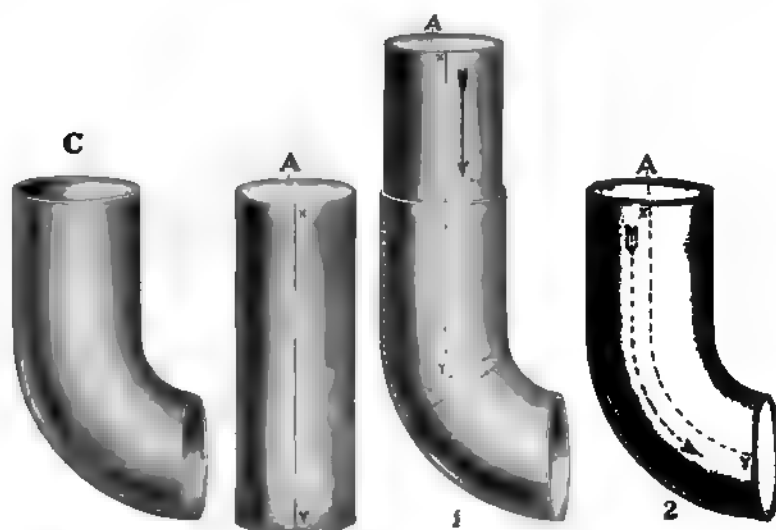


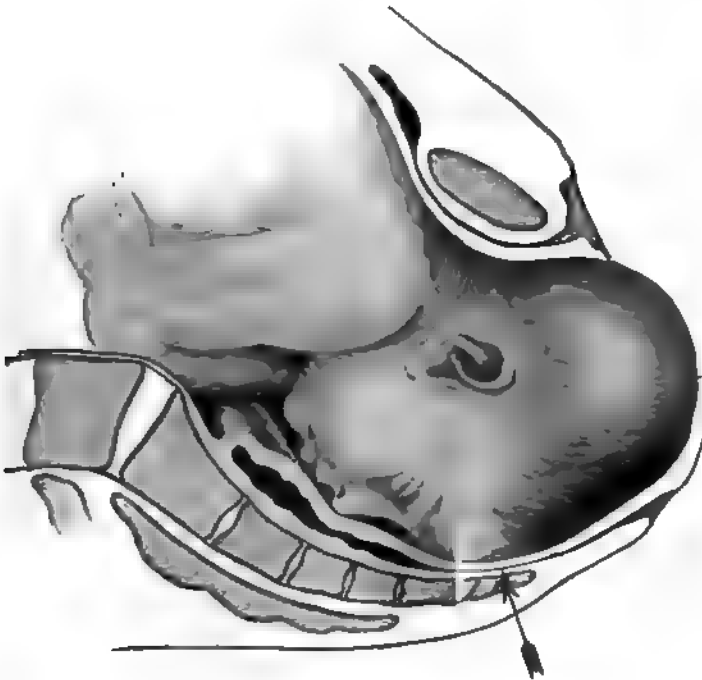
FIG. 212.—ACTION OF AN EVENLY FLEXIBLE CYLINDER WHEN FORCED THROUGH A CURVED PASSAGE. The cylinder A, uniformly flexible, in going through the canal C, will simply bend, the line X-Y not changing its relation to C.

and this deflexion is aided by the natural movements of the child. The head cannot be bent much onto the chest. Owing to the pressure of the arms and legs into the body and the construction of the spinal column, the trunk cannot bend sagittally, but may bend easily toward one or the other side.

One may readily see that the fetal cylinder will be bent in its passage through the curved birth-canal, to correspond with the curve of the canal. If the child were flexible evenly in all directions, a bending of the cylinder in an anteroposterior manner would be all that would be necessary. But the bending of the cylinder occurs only in certain ways—at the neck from before behind, in the trunk from one side to the other, and these two directions cross each other at a right angle. Therefore, in order for the fetal cylinder to pass through the curved canal, it must

bosses strike the sides of the levator ani near the rami pubis, and are held while the forehead is driven down and forward (Fig. 216). The perineum is placed downward as well as backward, a point of importance in considering tears of the pelvic floor and their repair.

*Internal Restitution.*—After the head is delivered it slowly rotates in a direction opposite to that taken in internal anterior rotation; that is, in O.L. positions the head turns to the left, in O.D. positions it turns backward toward the right, toward the mother. The movement is called "external restitution," and is due to twisting of the neck and to the impulse imparted to the head by the internal rotation of the shoulders. External restitution or rotation does not invariably occur, and occasionally the occiput turns in a direction opposite to that which is expected. This is due to an unusual internal rotation of the shoulders. When and where do these various movements take place? Descent or ad-



214.—INCREASED FLEXION OF HEAD AT PERINEUM. ARROW INDICATES DIRECTION OF FORCE.

Descent, progression or translation (Sellheim), occurs throughout the whole process, even when the head is rotating—a point to bear in mind when imitating the forceps method, as in a forceps delivery.

Flexion begins at the inlet of the pelvis, but may not occur until the head has reached the pelvic floor, when flexion and rotation occur almost simultaneously. It occurs at the end of the first stage in primiparae, and in all labors as the head is passing the cervix in the second stage. The flexion is exaggerated when the head disengages from the bony outlet of the pelvis, and this occurs about the end of the second stage.

Internal anterior rotation takes place in the excavation of the pelvis, just as the head comes to rest on the pelvic floor, and is completed when the head has reached the bony pelvis; though often, perfect rotation, bringing the small fontanel into the median line, may not occur at all, the head being delivered obliquely.

Absence of rotation can occur only when the child is small and the pelvis very large, and is pathologic. Internal rotation usually begins

in primiparæ when the first stage is ended and is completed before the second stage is half over. In multiparæ it occurs in the second stage.

Extension occurs after the forehead has passed the bony outlet, toward the end of the second stage of both primiparæ and multiparæ.

**Mechanism of the Shoulders.**—When the head becomes visible in the vulva, the shoulders engage in the inlet, the bisacromial diameter usually entering in the oblique opposite to that in which the head entered. In O.L.A. one finds the shoulders in the left oblique; in O.L.P. they enter in the right oblique. In O.L.A. the anterior shoulder rotates under the pubis from the right side of the pelvis, its direction of progression being opposed to that which the head underwent; while in



FIG. 215.—MOVEMENT OF EXTENSION AND DISENGAGEMENT.

O.L.P. the anterior shoulder follows the movement of the head from the left behind to the pubis in front. The movements imparted to the shoulders are engagement, rotation, and disengagement. General intra-uterine pressure forces the child down the parturient canal, and this action is reinforced by the direct pressure of the uterus on the fetal body. The anterior shoulder slides down the lateral wall of the pelvis until it reaches the pelvic floor, then rotates under the pubis. Anterior rotation of the shoulders is accomplished by the same factors which operate on the head—the shape of the pelvic floor, the direction of the opening in the pelvis, and the elastic resistances of the fetal body. Flexion of the child's trunk is necessary to accommodate it to the concavity of the pelvic canal. The child's body bends best laterally.

fore, according to Sellheim's law, the trunk will rotate until it corresponds to the direction of the curve of the canal through which it has to pass (Fig. 217). If no rotation of the back occurs, the shoulders appearing transversely,

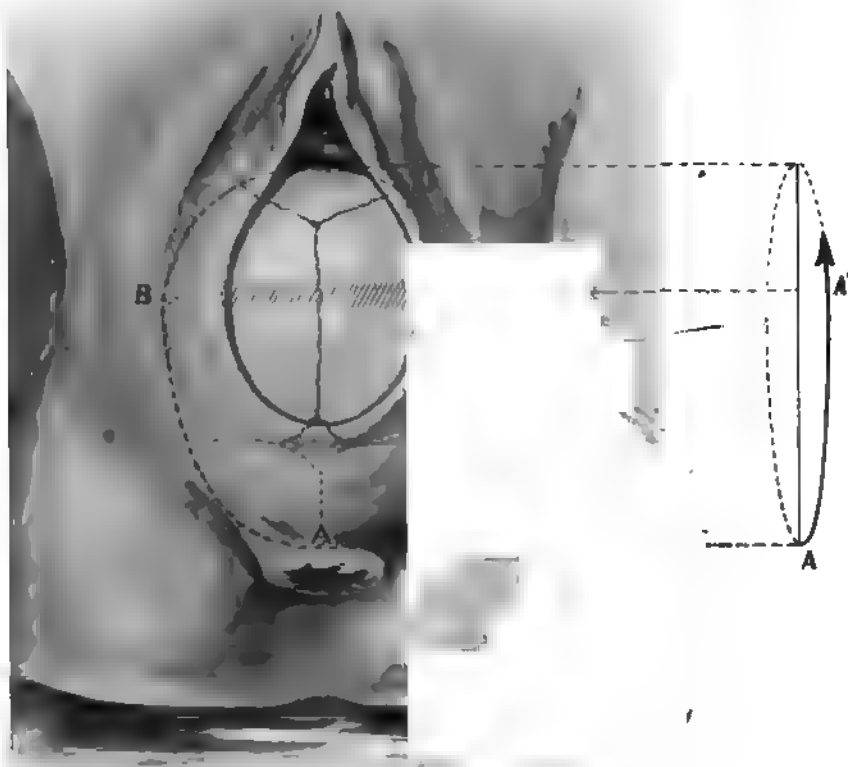


FIG. 216.—THE FACTORS IN EXTENSION OF FETAL HEAD WHEN ON PERINEUM. The head meets resistance at B B. There is a tendency for A to come down, which is opposed by perineal floor, giving curve A A'.

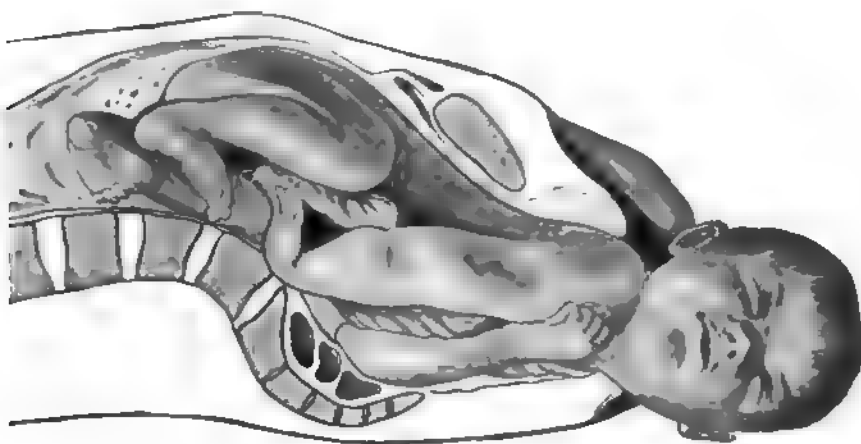


FIG. 217.—ZWEIFEL'S FROZEN SECTION OF A WOMAN WHO DIED AFTER DELIVERY OF HEAD.

and sometimes the shoulders rotate to the opposite oblique, the back appearing on the other side to that in which it was expected. Delivery of the shoulders is quite typical. The anterior shoulder stems behind the pubis, the posterior rolls up over the perineum, after which the anterior shoulder comes from behind the pubis. If the perineum is much torn, a reverse mechanism occurs. Often nature needs a little aid at this stage, and the accoucheur must imitate the natural modus of delivery. Trouble with the shoulders is rare unless they are large, but laceration of the perineum frequently results from carelessness in their delivery, and also may fracture of the child's clavicle—even Erb's paralysis. (See p. 836.) After the chest is born, the rest of the child follows without any particular mechanism.

**Over-rotation.**—One is occasionally surprised to note that a labor starting on O.L.A. becomes, in its course, an O.D.A., and external rotation follows such mechanism. In these cases the internal rotation was excessive, carrying the occiput beyond the middle line to the opposite side, or the internal rotation of the shoulders was reversed or excessive. The explanation of the phenomenon, after removing the question of error, is to be found in the laws governing the mechanisms, and on

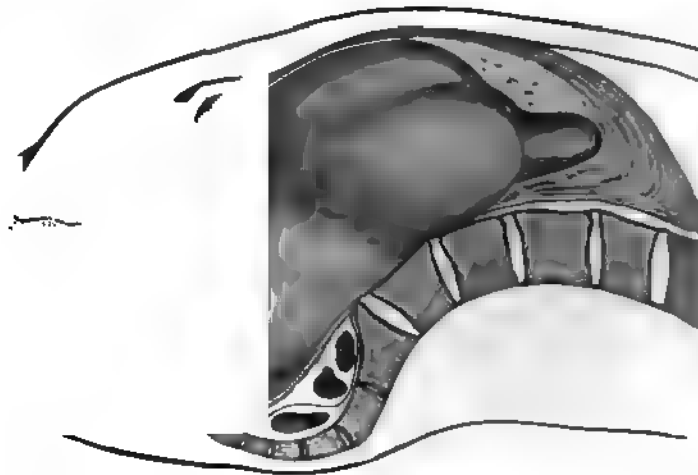


FIG. 218.—ZWEIFEL'S FROZEN SECTION OF A WOMAN WHO DIED AFTER DELIVERY OF HEAD.

usually finds that the child was small or the parts large and yielding, the factors in the production of a perfect mechanism being weakened.

#### LITERATURE

*Quild:* "Positio Occipito-pubica." Quoted in *Jour. Obstetrics and Gyn. of Great Britain*, October, 1908.—*Sellke:* *Die Beziehungen des Geburtskanals und Geburtsobjekts zur Mechanik*, Leipzig, Thieme, 1906, also *Handbuch der Geb.*, Doederlein, 1916, vol. 1.

**What One Observes of the Mechanism of Labor in O.L.A.**—Careful observation of the course of labor enables us to closely follow the mechanism, to determine at any time, its rate of progress, and to discover any variation from the normal. It is the knowledge of the mechanism of labor and the ability to recognize and correct abnormal variations that mainly distinguish the real accoucheur from the blind midwife, male or female. It will simplify and clarify this study if the student will follow the described mechanisms on the manikin or with a pelvis and fetal skull. Abdominal examination furnishes most valuable information, is less dangerous to the patient, less painful, and should always be practised first, though it is often necessary to supplement it by internal, rectal, or vaginal exploration.

At the beginning of uterine contractions the uterus is more globular than later and slightly more pendulous. The head is higher up, and movable above the inlet

cially in multiparae, and the back is usually far to the side. When the contractions attain regularity and severity, the uterus lengthens, the head becomes 1 over the inlet, and the back shows a tendency to come to the front, or go her back to the side, the latter movement depending on the position—whether anterior or a posterior one. Fig. 219 shows the hands palpating the head before engages in the pelvis; one sees how the fingers can move the head from side to side above the inlet. Fig. 220 shows the hands as they come to rest on the head, r it has engaged; one hand feels the occiput deep in the pelvis, to the left, ind the pubic ramus; the other hand finds the sharp forehead on the right and ewhat behind the median line. When flexion is marked, as in generally con-



FIG. 219.—MOVING HEAD FROM SIDE TO SIDE ABOVE INLET. HEAD NOT ENGAGED. Arrows show direction of movements. This maneuver may also be carried out bimanually, with fingers in the vagina.

stricted pelvises, one can hardly feel the occiput, it is so low in the pelvis, but the forehead is high up and easily palpated. If one now tries, with the two hands, to push the head from side to side, it will be found impossible: the head is fixed. As labor goes on and internal anterior rotation occurs, the occiput sinks behind the left pubic ramus out of reach of the external hand, and the forehead rises, then turns, dis-

appearing in the right flank. When the occiput sinks beyond the reach of the finger the head is engaged.

The back at first is directed to the left side, but as labor advances it rotates to the front. One can follow the anterior shoulder as it goes from the left, behind above, to the middle line just over the pubis. The movement of the back is as depicted by the course of the fetal heart-tones. At first the point of their greatest intensity is about the level of the navel, on the left; this point descends and comes to the median line until, when the head is on the perineum, the heart is best heard just above the pubic hair margin.

On vaginal exploration, early in labor, one finds the cervix closed or admitting only one or two fingers, which renders the diagnosis very difficult. In prim



FIG. 220.—PALPATING THE ENGAGED HEAD.

para the head is often engaged; in multiparae it usually lies in the inlet, but freely movable, floating, or "caput ballitabile." The finger in the cervix comes up to the soft bag of waters, and through this feels the head. Lying across the os is the sagittal suture, running medially (synclitism) or nearer the promontory, or pub (asynclitism), and at the end of the suture, in the left anterior pelvic quadrant, the finger finds the small fontanel. At the other end, in the right posterior quadrant, but nearly on a level with the small, lies the large fontanel. These findings indicate that flexion has not yet occurred. Flexion having taken place, one finds the small

vel lower in the pelvis and nearer its center, the large fontanel higher and to reach, the sagittal suture more nearly paralleling the axis of the body, and almost in the right oblique. That fontanel which is nearer the center of the is the lower one. Internal anterior rotation occurring, the small fontanel de-



FIG. 221.—COURSE OF FETAL HEART-TONES IN O.L.A.

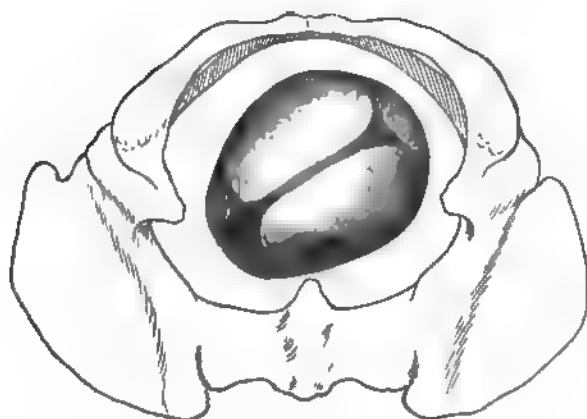


FIG. 222.—HEAD READY FOR ANTERIOR ROTATION IN O.L.A. VIEWED FROM BELOW.



ascends and sweeps around the left anterior quadrant of the pelvis until it lies directly behind the pubis, the sagittal suture now running exactly in the median line from before backward (Figs. 222, 223, and 224). Coincident with these movements the effacement and dilatation of the cervix have been taking place, and usually, by the

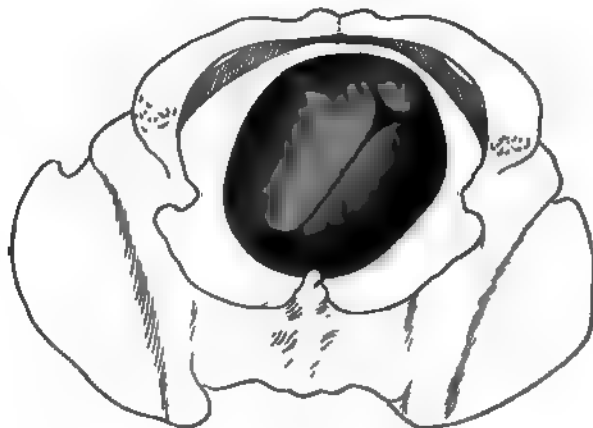


FIG. 223.—O.L.A. FLEXION AND ANTERIOR ROTATION BEGUN.

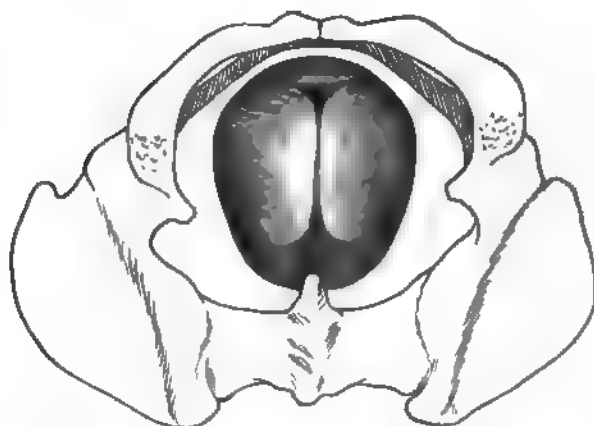


FIG. 224.—O.L.A. ANTERIOR ROTATION COMPLETED.

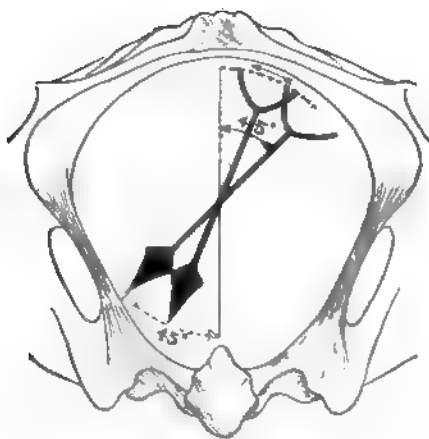


FIG. 225. ROTATION IN O.L.A.  
Occiput has an arc of only 45 degrees to travel.

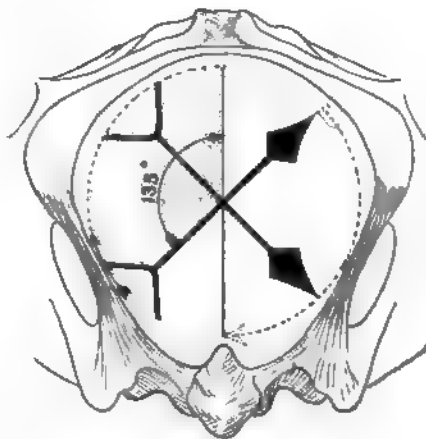


FIG. 226.—ROTATION IN O.D.P.  
Occiput has an arc of 135 degrees to travel.

comes to rest in the perineal gutter, the os is completely dilated and the neck. A caput succedaneum begins to form, and in long, may grow so large that it makes the landmarks on the skull hard to assure or massage will obviate the difficulty. Of equal importance in the rotation is the recognition of the degree of engagement of the head—the "station" (Müller). It is not so easy to determine the degrees of the head along the birth-canal. Older writers sought to decide the position of the head up, and much use was made of the terms "caput



FIG. 227.—COURSE OF FETAL HEART-TONES IN O.D.P.

bile, and ponderosum." When the head floated above the inlet, it put ballitabile"; when it was fixed at the inlet, "caput mobile"; when lvis, "caput ponderosum." A head that is even visible at the outlet l up out of the pelvis, and a head that is not engaged may be fixed so be moved; therefore, one may not be guided by the displaceability. gaged when its largest plane—that is, the one through the parietal used the region of the inlet. How may we determine that such has e know that the head is engaged when, first, the most dependent skull (not the caput succedaneum) has passed a line drawn between e ischia; second, when two-thirds of the sacrum are covered by the ence, that is, the sacral hollow is occupied by the head; third, when feel only one-fourth of the pubis. Of these three criteria, the one

measuring the distance of the head above or below the interspinous line is the most valuable and reliable. (See pages 297 and 725.)

Engagement varies with the different presentations of the head. It is prevented by highly contracted pelves, tumors blocking the inlet, and by pendulous abdomen. An abnormally large head engages with difficulty; the placenta may be in the way, or a large amount of liquor amnii (polyhydramnion) may confer great mobility on the fetus. Whenever the head does not engage, the cause must be sought out, and one may not attempt delivery until the degree of engagement is positively known.

In the occipitodextra anterior position, the mechanism of labor and the findings are the same as in occipitolæva anterior, but reversed.

#### MECHANISM OF LABOR IN OCCIPITODEXTRA POSTERIOR POSITION

One essential difference exists in the mechanism of O.D.P. as compared with O.D.A.—the occiput has to rotate through an arc of 135 degrees, three-quarters of a half-circle, while in O.D.A. it rotates through an arc of 45 degrees, only one-quarter of a half-circle (Figs. 225 and 226).

Engagement of the head is slower because the broad part of the head is likely to impinge on the promontory of the sacrum, and for the same reason flexion is not so marked, and may not occur until the head is well down on the pelvic floor. Internal anterior rotation takes much more time—naturally, since the occiput has three times as far to travel. After it has occurred, the mechanisms of all positions are identical. The factors bringing about all the movements are the same in posterior positions as in anterior, and a new one is invoked. It is believed that the shoulder, striking on the promontory of the sacrum, prevents the back, and therefore the head, from rotating backward. Sellheim explains anterior rotation by his law of adaptability of a body, flexible best in one direction, being forced to accommodate itself to the curve of the container. Anterior rotation does not invariably occur—sometimes the occiput rotates backward to the hollow of the sacrum (3 per cent. of the cases), but then the labor is pathologic. This phase of the subject is considered on p. 596.

**The Findings in Occipitodextra Posterior.**—*Abdominally*, the back is felt to the right and posteriorly, and the heart-tones are deeper in the flank, further from the navel. During labor, both gradually come anteriorly, sinking at the same time (Fig. 227). The shoulder is on the right side of the median line, and turns to the front, then to the left side of the center, as labor progresses. The forehead, at first, is plainly felt above the left ramus of the pubis. It rises a little higher, due to flexion of the head, then it sinks lower as the head engages; finally, it sweeps backward, around the left half of the pelvis, disappearing at the side. The small parts, feet and arms, are felt anteriorly around the umbilicus. *Internally*, at the beginning of labor, the head is high up, the sagittal suture in the *right* oblique, the large fontanel in the left side anteriorly, the small fontanel high up, and at the right sacro-iliac joint. Flexion is less marked in these cases. After descent is started the flexion of the head throws the small fontanel nearer the center of the pelvis, the large fontanel recedes, and the sagittal suture becomes more vertical. Should flexion fail, the head reaches the perineum, the small and large fontanels descend in nearly the same plane, the sagittal suture running more or less transversely (Fig. 230). After rotation is complete the findings are the same as in O.D.A.

**Labor** is always longer, harder, and more painful, and effacement and dilatation of the cervix not so complete, in occipitoposterior positions. In pathologic cases the powers of labor may give out before rotation is accomplished, and then we have a condition known as "arrest," of which more later.

In O.L.P. the mechanism of labor and the findings are the same as in O.D.P., but reversed.

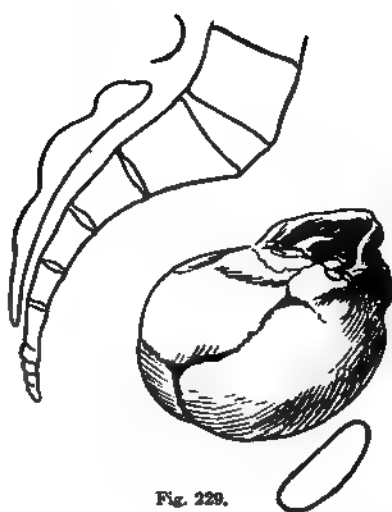
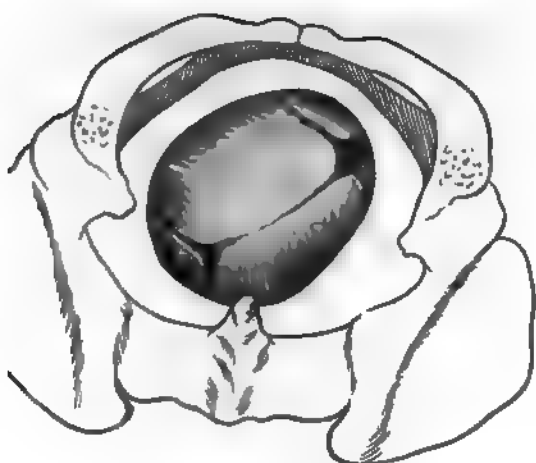


Fig. 228.  
FIGS. 228 AND 229.—ROTATION IN O.D.P. (Seen from below and from the side.)

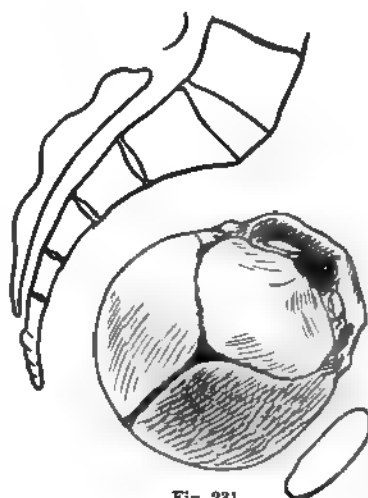
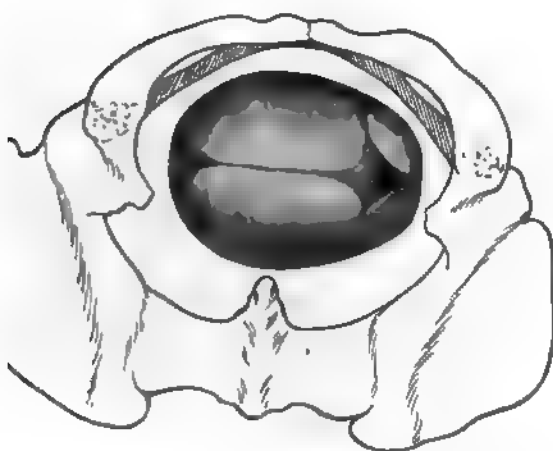


Fig. 230.  
FIGS. 230 AND 231.—It is now called O.D.T. (If rotation stops here, it is called transverse arrest.)

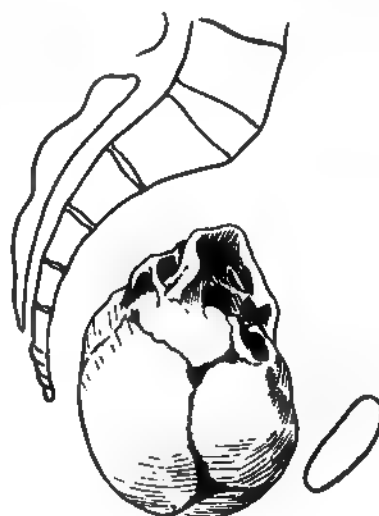
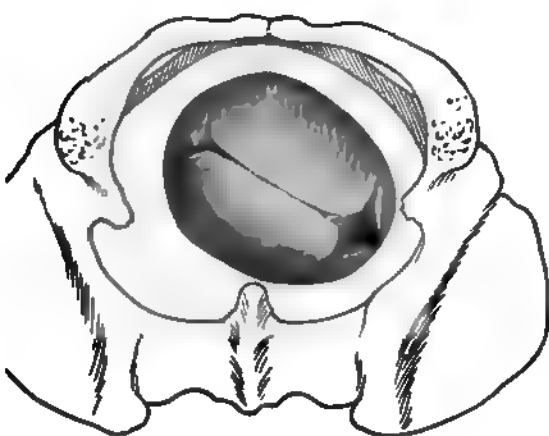


Fig. 232.  
FIGS. 232 AND 233.—ROTATION IN O.D.P. (Now it has become O.D.A.)

## CHAPTER XIII

### THE MECHANISM OF THE THIRD STAGE

Two acts make up the delivery of the placenta: separation or detachment of the organ and its expulsion.

It is not probable that the placenta always separates as the trunk of the child leaves the uterus. Observations at cesarean sections show that the placenta remains adherent to the uterus during the first moments of retraction of the fundus. The uterine wall is thick everywhere but at the placental site, which is nearly as large as it was before delivery (Fig. 234). During the second stage of labor the placenta may shrink somewhat, to accommodate itself to the diminishing size



FIG. 234. PLACENTA STILL ATTACHED TO UTERUS AT BEGINNING OF THIRD STAGE.

\*Note thin uterine wall at placental site. V. para, died in second stage, forceps, living child, frozen section (adapted from A. Couvelaire).

area of attachment, but after the child is out, the first uterine contraction is such a diminution of the surface area that separation is inevitable. This break in continuity allows a little blood to escape between the two organs, and next uterine contraction forces this blood, like a fluid wedge, between the layers of decidua serotina, separating the placenta in the smoothest and most perfect

anner from the wall of the uterus. Since the placenta is more adherent at the lges, the hemorrhage behind it will lift up the center, as is depicted in Fig. 235. his blood-clot is called the "*retroplacental hematoma*," and varies much in size, pending on the method of extrusion of the placenta. When too brusque man- ulations are made on the uterus, the edge of the placenta will separate at one ace, allowing the retroplacental blood to escape externally, thus producing an ormal mechanism of the third stage.

A third factor in the separation of the placenta, but a minor one, is the loss of e intra-uterine pressure. There is now nothing to hold the placenta against the all of the uterus.

A fourth factor, traction on the placenta by a too short cord,—35 cm.,—or e coiled around the neck of the child, is pathologic.

*Expulsion* of the placenta begins when the separation is complete, or nearly so. he uterine contractions force the placenta against the internal os, and finally, rough it, into the dilated cervix and upper vagina. From this point another force akes up the work—the abdominal muscles. Among the savages and ignorant eople various methods of invoking the abdominal pressure are employed, as oughing, sneezing, blowing into a bottle or the fist, pushing on the belly, or squat- ing, as at stool. The accoucheur directs his patient to bear down, which failing, he xpels the placenta by pressure on the uterus. Few authors commend pulling on

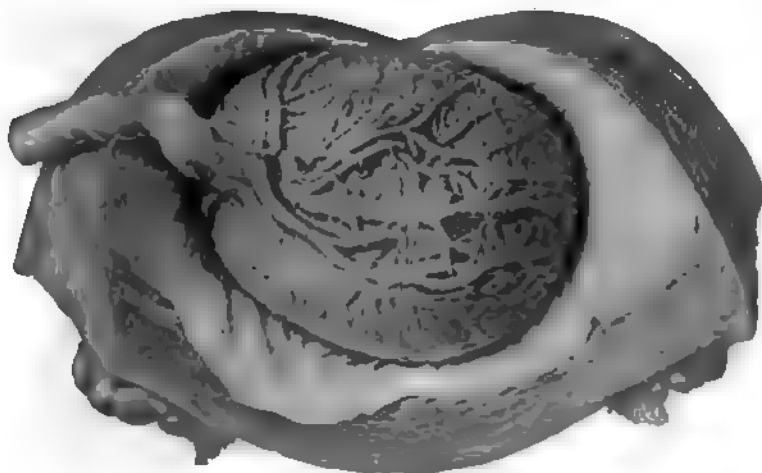


FIG. 235.—SHOWING HOW PLACENTA IS RAISED UP BY RETROPLACENTAL HEMORRHAGE.  
Specimen kindly loaned by Prof. Pisceček, of Vienna.

re cord. In pathologic cases an accumulation of blood may force the placenta out f the uterus.

During the delivery of the after-birth one observes two mechanisms: First, e placenta turns inside out like an umbrella, the fetal surface comes out first, the ord leading the way, the membranes containing the retroplacental hematoma fol- wing after. This is called Schultze's method. Second, the lower edge of the lacenta precedes, the whole organ sliding down the side of the uterus in the vagina. his is called Duncan's method. In the latter cases the retroplacental hematoma small, or the edge of the placenta may have been inserted low, near the internal s, or the contractions of the uterus may have been unusually strong from the start, ickly separating the placenta and folding it together ready for extrusion. In pposite conditions we notice Schultze's method which is also more common when e placenta has a fundal insertion. Duncan's method is more likely to occur if e placenta is already near the internal os. Although Baudeloque described oth mechanisms, they have been assigned the above names, and which is to be

considered normal or more frequent for a time occupied the discussion of authorities. My own observations, with the cervix exposed by broad retractors, prove that a pure Duncan method is rare, a combination of the two mechanisms being the rule, but that the placenta emerges from the vulva most often like an inverted umbrella (see Figs. 242 and 245).

The membranes are mechanically drawn off the wall of the uterus by the descending placenta, but the firm contraction of the muscle also helps in their separation. They are also detached in part by the retroplacental hematoma, but when

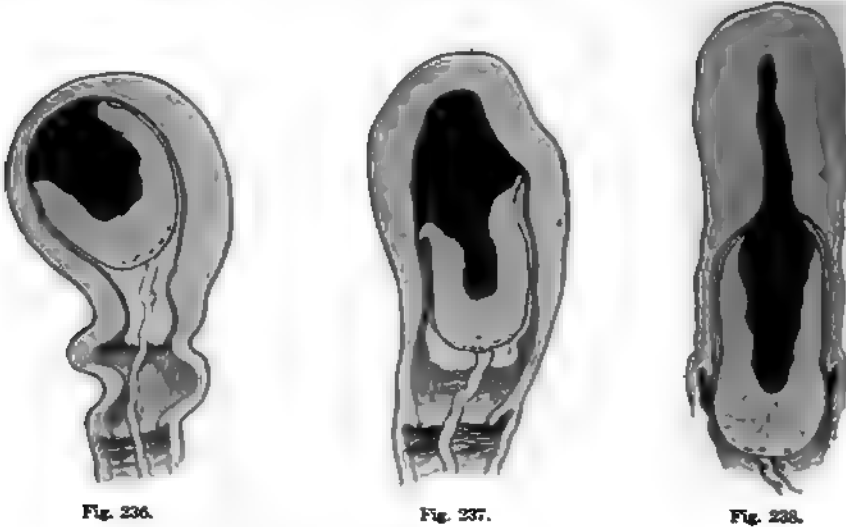


Fig. 236.

Fig. 237.

Fig. 238.

FIGS. 236, 237, AND 238.—SCHULTZE'S MECHANISM OF EXPULSION OF PLACENTA.

this is extensive, the process is pathologic. After the placenta is outside of the vulva, the membranes follow to gentle traction or by the weight of the placenta, or by their own weight, if completely separated. Normally, the membranes—consisting of the amnion, the chorion, the decidua reflexa, with portions of the vera and part

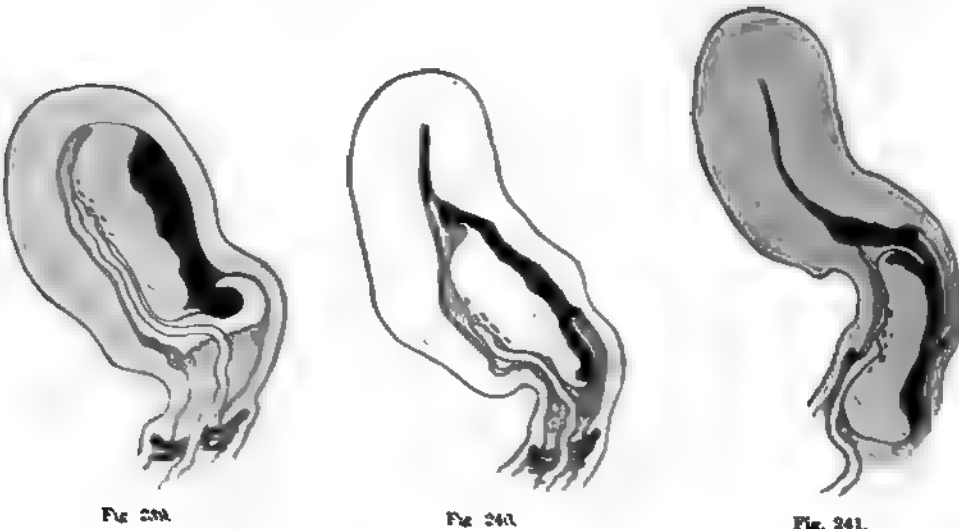


Fig. 240.

Fig. 241.

Fig. 242.

FIGS. 240, 241, AND 242.—DUNCAN'S MECHANISM OF EXPULSION OF PLACENTA.

of the decidua serotina are expelled still adherent to each other. Where the head has been delivered covered with a "caul,"—the amnion,—a separation has occurred

the chorion and amnion, and one finds the latter folded around the cord, to the placenta only at the insertion of the latter. In pathologic cases, or where too brisk manipulations have been carried out in the third stage, the placenta is delivered, leaving more or less of the membranes still attached to the uterus. These portions of the secundines undergo fatty degeneration and

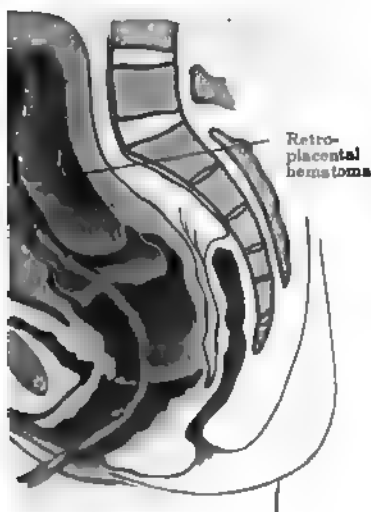


Fig. 242.

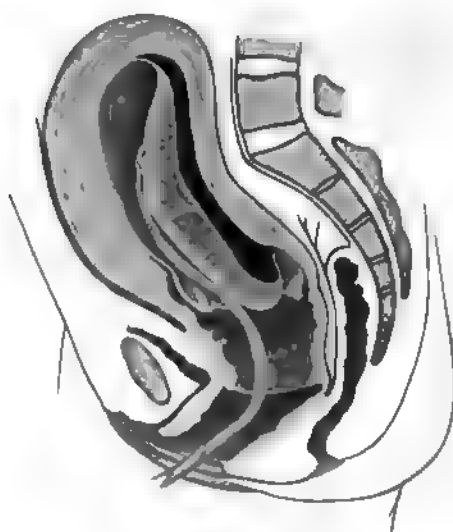


Fig. 243.

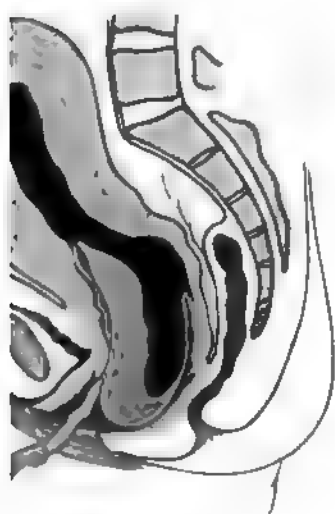


Fig. 244.

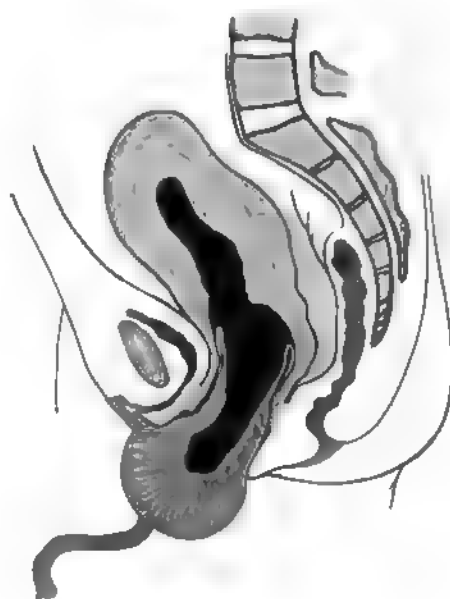


Fig. 245.

FIGS. 242, 243, 244, AND 245.—USUAL MECHANISM OF EXPULSION OF PLACENTA.

with the decidua during the puerperium; or, rarely, they become in- cause puerperal fever.

scopically, one finds that the separation of the placenta and membranes the glandular or ampullary layer of the decidua—sometimes deeper, more superficially. The soft, pink, incomplete layer of tissue to be found



on the maternal surface of the chorion is decidua vera and reflexa, and one can find blood-vessels in it. The gray, translucent covering of the placenta is decidua serotina, and the broken-off veins and arteries of the placental site can always be demonstrated in it. These thin-walled vessels, the glandular spaces, and the absence of fibrous tissue make the decidua a very soft structure, and, therefore, separation of the secundines is very easy. In Fig. 46, page 36, the wrinkling of the decidua and the superimposed membranes is shown. This is due to the reduction in size of the uterine surface. One can rub the decidua off the uterus with a gauze sponge. In pathologic cases the decidua serotina does not develop, is absorbed early, and the chorionic villi burrow down into and between the muscular fibers. Dangerous adhesion of the placenta results, necessitating its open removal. (See Placenta Accreta.)

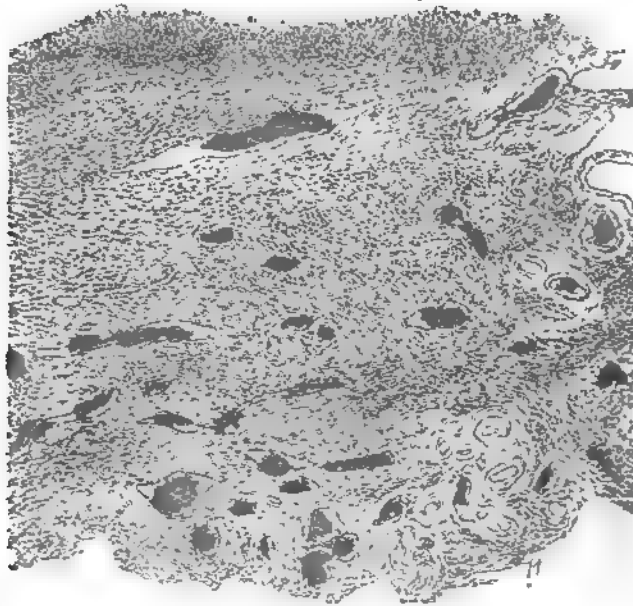


FIG. 346.—THROMBOSIS IN UTERUS AFTER ABORTION OF SIX WEEKS. ABNORMAL, INSUFFICIENT RETRACTION OF UTERUS. Woman twenty-six years old.

Hemorrhage from the large sinuses of the placental site is controlled by contraction and retraction of the uterine muscular fibers and lamellæ. They act like "living ligatures" on the thin-walled vessels coursing through the uterus. The shifting of the layers of muscle and shortening of the bundles of fibers displace, press, twist, and bend the thin-walled vessels, so that they are no longer pervious. Thrombosis in the sinuses does not normally occur, but occasionally one finds the surface left bare by the placenta, a few thrombi occupying the open mouth of the vessels. Thrombosis of the deeper placental site is pathogenic—it may lead to embolism and it invites sepsis.

# SECTION III

## THE PHYSIOLOGY OF THE PUERPERIUM

### CHAPTER XIV

#### LOCAL CHANGES

WITH the completion of the third stage, labor is ended; the puerperal state has begun; the woman is a puerpera. The puerperium may be defined as that period which extends from the delivery of the ovum until the return of the genitalia to the non-pregnant state is complete. Its length, therefore, is from six to eight weeks, though in common usage the

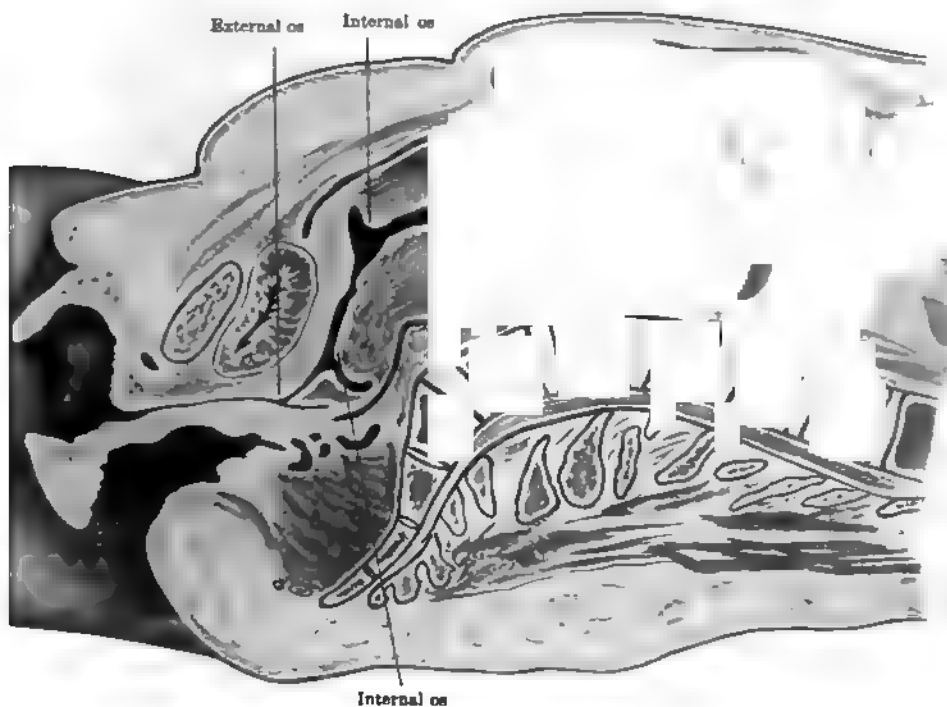


FIG. 247.—UTERUS DIRECTLY AFTER LABOR.  
Section of a primipara who died one hour after delivery, from hemorrhage and fatty heart (Stratz). Usually, there is no gut in front of the fundus.

puerperium means the time the woman is in bed after the labor. As has been repeated, a perfect restitutio ad integrum never occurs after labor. The woman bears the evidences of child-bearing all her life. The distinction between normal and pathologic conditions during the puerperium is not easy, even with the aid of the thermometer and of bacteriology. The rapid disintegration of the uterus, the

changes in the endometrium, and in the open vessels at the placental site, closely akin to the pathologic, and would be called such if they occurred at any time or place. It is the same approach to the abnormal that renders permanent structural disease so prone to begin during the puerperal period.

In the physiology of pregnancy we learned of all the changes, local general, which provided for the growth of the child and its expulsion from mother. These were progressive changes. In the physiology of the puerper we will study the retrogressive changes, local and general, which bring back

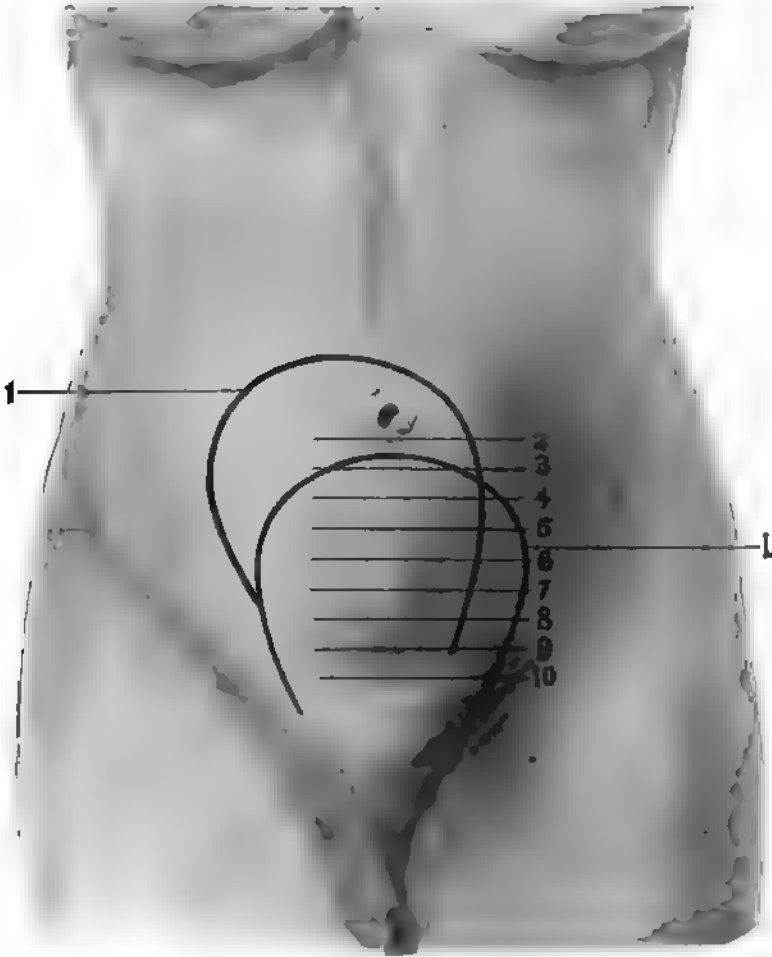


FIG. 248.—HEIGHT OF UTERUS POSTPARTUM. THE BLADDER EMPT.  
L, After labor. 1, First day; 2, second day, etc.

organs of the mother to their original condition, and, second, those progressive changes in the breasts which enable them to carry further the function begun by the uterus—the nourishment of the child. The retrogressive changes of the puerperium are grouped under the general heading “Involution.”

**Changes in the Uterus.**—Immediately after delivery of the placenta the uterus sinks below the level of the navel in strong anteversion and antelexion, resting the promontory behind and lying against the abdominal wall in front (Fig. 248). Owing to its previous displacement, its ligaments and vaginal attachments are so loose that the fundus may easily be moved to any part of the belly,—even as high

iver, or may be pushed down so that the cervix hangs out of the vulva. The is now resembles a flattened pear; it is 15 cm. long, 12 cm. broad, and 8 to 10 thick, being about as large as a fetal head, and it weighs about two pounds. full bladder always displaces the uterus, and usually the latter rises toward the side. On vaginal examination immediately after labor one can hardly outline ervix, it is so soft and succulent, hanging down from the hard contracted mus- fundus in folds, like a cuff. It is about 1 cm. thick and 6 or 7 cm. long, but be stretched to 10 or 11 cm. The internal os or contraction ring firmly closes terine cavity and marks the point where the thick fundus goes into the thin



FIG. 249.—UTERUS, FIFTH DAY POSTPARTUM (from Bumm).

terine segment and cervix. Either a small blood-clot fills the cavity of the or the walls lie apposed. At the placental site the uterine wall is thinner sewhere until a few contractions have occurred; then it is thicker, and one zes the location of the placenta by the roughened, raised surface. This ned, raised surface is normal, and must not be mistaken for a piece of ad-placenta. Measurements by Fehling show the thickness of the wall to om  $3\frac{1}{2}$  to 5 cm.

ving to the development of the elasticity of the vagina and pelvic floor, and ng of the rectum and bladder, the uterus rises in the abdomen on the first the puerperium; but from then on one observes, from day to day, a steady

decrease in height above the pubis and in all its diameters (Fig. 248). The t from Temesvary gives the measurements, which were taken when the bladder rectum were empty and when the uterus was held up against the abdominal v i. e., the antelexion corrected.

Day	HEIGHT ABOVE PUBIS	BREADTH AT TUBAL INSERTION
After delivery	10.91 cm.	11.05 cm.
First day . . .	13.55 "	12.27 "
2d "	12.45 "	11.71 "
3d "	11.16 "	10.93 "
4th "	10.21 "	10.27 "
5th "	9.29 "	9.66 "
6th "	8.22 "	8.96 "
7th "	7.61 "	8.32 "
8th "	7.32 "	8.19 "

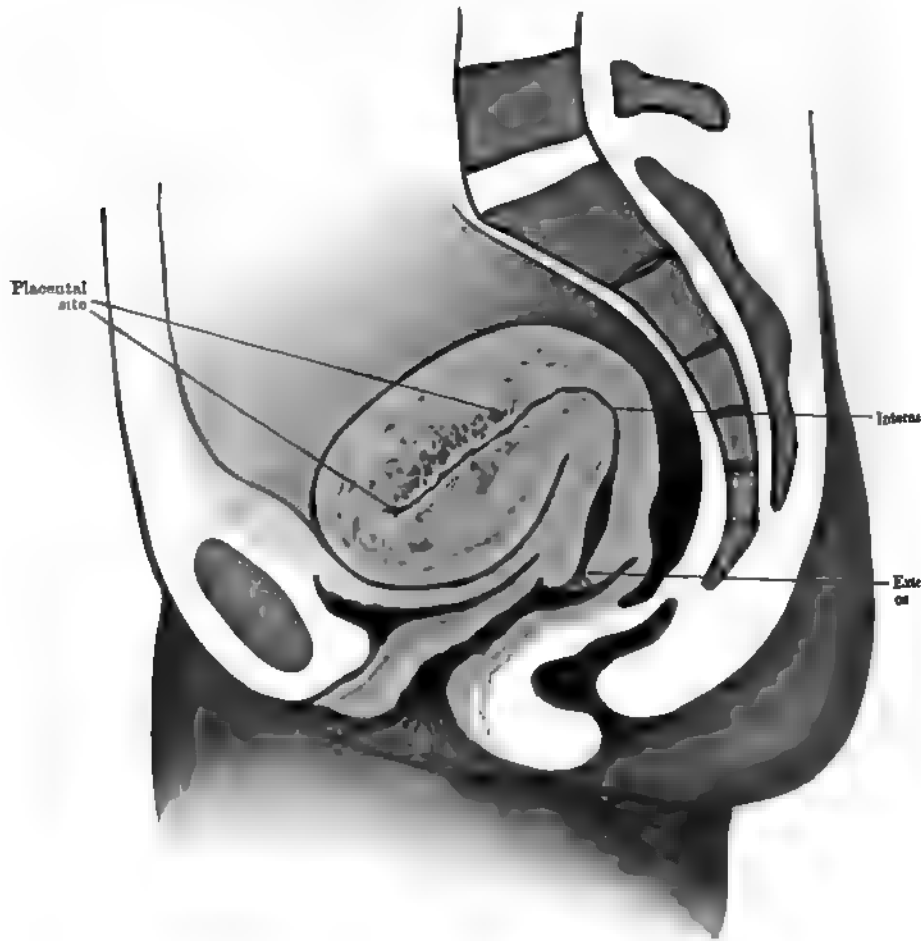


FIG. 250.—UTERUS, TWELFTH DAY POSTPARTUM (Bumml).

While one may follow the descent of the uterus with the tape-measure, for practical purposes the rule of the fingers is sufficient. On the first day the uterus seven or eight fingerbreadths above the pubis; on the fifth day four or five, and correspondingly narrower across the fundus; while by the twelfth day it has sunk low the inlet so that it is not easily palpable from the abdomen (Figs. 249 and 2

After delivery the uterus weighs  $2\frac{1}{2}$  pounds, or 1000 gm.; by the end of the first week it has lost one-half—500 gm.; at the end of the second week it weighs 150 gm. (about 11 ounces); while in the eighth week it again is the small organ of two ounces, or 60 gm.

This rapid diminution of size is brought about by absorption of the tissue-juices and fatty degeneration of the muscle-fibers. Sanger showed that the fibers are not all nor fully destroyed, but the protoplasm undergoes cloudy swelling, hyaline and fatty degeneration. The fat is removed by the lymph-stream, by oxidation, by the action of a fat-splitting ferment, and partly by the leukocytes. That fatty degeneration of the muscle protoplasm is not the only method nature has for reducing the uterus is indicated by the demonstration of glycogen (Broers) and peptone (Hofmeister) in the muscle. The connective-tissue fibers also undergo hyaline fatty degeneration and partial absorption. A multiparous uterus is usually thicker and more fibrous. Little is known of the changes in the nerves.

The uterine vessels are compressed by the contracting uterus, causing the anemia which is the basal factor of the changes described above, and obliterating the vessels themselves, with hyaline and fatty degeneration of their walls and exclusive growth of the endothelium (E. Ries). Thrombosis occurs in the walls of the deeper veins only in pathologic cases, but a superficial thrombosis is not abnormal. These thrombi are organized in the usual manner during the puerperium. The placental site, after the placenta has left it, contracts rapidly, presenting a raised and nodular surface about three inches in diameter; by the fourteenth day it is the size of a silver dollar, and in six weeks may still be recognized by its elevated, though not roughened, surface, which is the size of a quarter.

The uterine serosa, in spite of its elasticity, cannot follow the receding uterus. It lies in fine wrinkles which are well shown in Fig. 125, p. 97. They disappear within a week. Their distinctive grouping shows the direction of the contraction of the muscle-fibers.

The *cervix*, after labor, hangs down like a soft cuff, succulent, bruised, sometimes almost black with suffused blood, edematous, and more or less torn. The author has never failed to find more or less injury to this organ, even after natural and easy labors. The serous infiltration disappears rapidly, and within eighteen hours the cervix forms, quickly shortens, and becomes harder. On the third day two fingers still pass easily into the uterus; on the twelfth day one finger can attain the internal os, but cannot go through it; while in the fourth week the os is a small transverse slit.

**Changes in the Endometrium.**—During pregnancy the glandular layer of the decidua vera and serotina undergoes a fatty degeneration. The separation of the placenta and membranes takes place in this layer; therefore, when the uterus is emptied, its mucous surface is denuded, the connective-tissue spaces being exposed all over, and, at the placental site, almost to the muscle. The interior of the uterus is one large wound, with, at the placental site, immense veins, containing superficial thrombi, opening upon it. This condition explains the ease of infection and the severity of the disease if it once gains entrance. An invasion of the decidua by white blood-corpuscles takes place, forming a layer of granulation, which separates the necrosing parts of the decidua from the healthy. At first the endometrium varies from 2 to 5 mm. in thickness, the surface is rough, with shreds of degenerating decidua, blood-clots, and bits of fetal membrane. By the third day this, as the result of fatty degeneration, has softened so that it could be wiped off with the finger, but nature accomplishes it in a better way. The granulation wall separates the dead from the living tissues, the remaining decidua cells, in part, return to their original condition, the epithelium from the stumps of the glands which lay unaffected among the muscle-fibers and which now crowd closer together as the uterus shrinks, proliferates rapidly, grows out on the surface of the endometrium, and covers the new mucous membrane. Thus the larger part of the endo-

metrium is cast off, regeneration taking place from the connective-tissue beneath the mucous membrane and from the epithelium of the deepest portions of the utricular glands (Fig. 251). It closely resembles the healing of a granulation face on any mucous membrane.

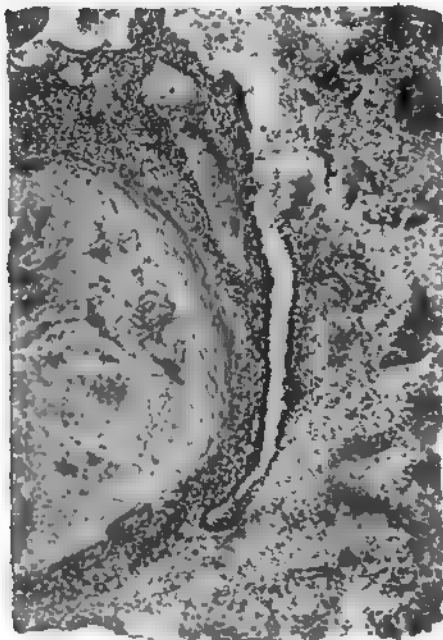


FIG. 251.—REGENERATION OF PLACENTAL SITE SHOWING NEW GLANDS FORMING NEAR BY NORMAL TISSUE (specimen presented by Dr. Warthin).

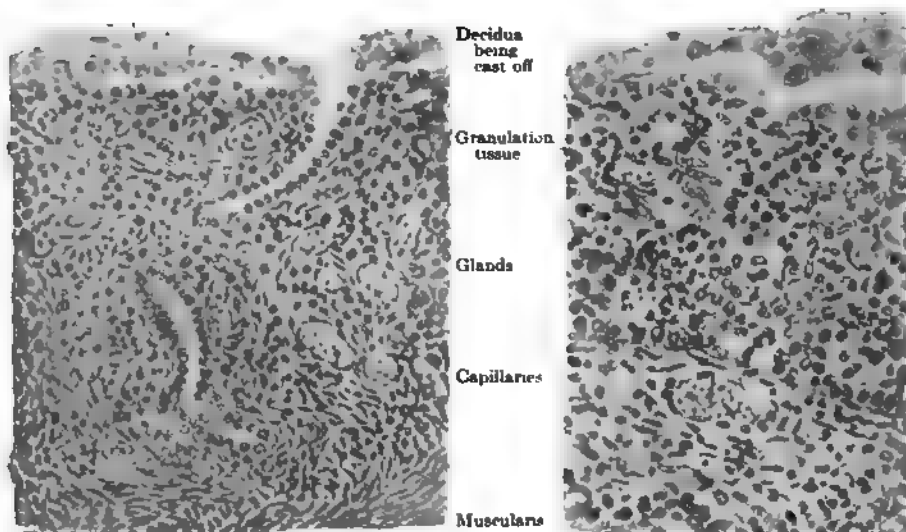


FIG. 251a.—REGENERATING ENDOMETRIUM ABOUT THE EIGHTH DAY OF PUERPERIUM, SHOWING NEW GLANDS FORMING.

FIG. 251b.—GRANULATION TISSUE FORMING IN THE ENDOMETRIUM DURING FOURTH DAY OF PUERPERIUM.

At the placental site similar processes occur, with, in addition, the thrombosis and organization of the open mouths of the vessels. The changes here are slower than in the *vera* (Fig. 253).

**Changes in the Vagina and External Genitalia.**—After labor the vagina is found swollen, blue, bruised, pouting into the vulva; but it soon regains

onicity, though only after years to a degree approaching normal. The saturated blood is absorbed in a week, the prolapse of the walls becomes less, the anterior wall of the vagina usually remains permanently lower. The y of the perineum is reestablished with surprising rapidity; perineal tears, though large and deep are small the next day, but just as important, however. The consistence of the vagina and perineum remains for weeks after delivery. The tissues are distensible to only a certain degree, after which they break like hard; the blood-vessels are friable, and operations performed during the puerperium are likely to be complicated by troublesome capillary oozing. Many ruptures of the vagina sub coitu have been reported as occurring in this condition and bleeding is always a prominent symptom. The vagina and mucous membrane of the vulva have a deep-red, velvety appearance, by which the puerperal condition usually be diagnosed.

The pelvic floor, containing muscle, fat, and fascia, is infiltrated with bloody clots full of small suggillations, even some larger blood extravasations. The fibers are often torn and overstretched. Absorption of the blood and clotting quickly takes place, but many minute and larger scars are left, which result in a weak and a weakened pelvic floor.

**Puerperal Wounds.**—A study of the healing process of the wounds made during labor forms an essential part of the duties of the accoucheur. The hymen is torn in every labor, and its relics are found as a row of mucous membrane tags at the vaginal orifice and called *carunculæ myrtiformes*. Around the clitoris, the labia minora, the introitus vaginæ, in the vagina, in the cervix—especially in the vagina—occur larger or smaller lacerations, bruises, and scraped surfaces. These may heal by apposition and primary union, or by granulation and suppuration. Lacerations of the perineum occasionally heal by primary union, but usually break up from the bottom. Sometimes the skin unites, but the body of the wound, the physiologically important part, does not unite well. Lacerations of the vagina usually heal readily, but with scar formation, which, if marked, will displace the base of the bladder, producing incontinence of the urine, or dislocate the uterus, producing sterility and other noxious conditions. Cervix tears occasionally heal by primary union. If infected they do not, but may give rise to cellulitis in the adjacent broad ligaments, with resulting life-long invalidism.

In the absence of infection these wounds heal with very little inflammatory reaction. The surface is covered with a light-gray exudate. Underneath this a pointed granulations appear, the surface cleans off, epithelization rapidly follows, and by the eighth day is usually nearly completed. Abnormal wound repair is due to infection somewhere in the parturient canal. Swelling of the labia, around the wounds, which have a reddened, angry aspect, greenish, yellowish, or even dark sloughing of the surface of the wounds, pain, fever, and illness, indicate that the normal process is being interfered with by infection.

**Lochia.**—Another striking phenomenon of the puerperium is the appearance of the lochia, a discharge from the genitalia at first bloody, then sanguineous, then purulent, finally mucoserous, before ceasing entirely, in three to six weeks. On the first day the lochia are almost pure blood, normally not mixed with clots—*lochia cruenta* or *rubra*. Clots, unless large and numerous, are not insignificant. This is followed by one of blood-stained serum, which lasts a day or so, after which the discharge is thicker, of a maroon color and creamy consistence, with a characteristic odor—*lochia sanguinolenta*. Gradually the bloody admixture grows thinner as white blood-corpuscles increase, the lochia resemble cream,—*lochia alba* or *creta*,—until at the end (thirteenth to the seventeenth day) there is only a slight mucous discharge.

The odor of the lochia varies from day to day, varies with the patient, some women naturally possessing a peculiar odor (even with the menses), and with the bacteria present in the vagina. Normally, the odor is not very offensive,



being faded or insipid, like old meat, or strong, like perspiration. If the lochia are fetid, or have a fruity, purulent odor, or sharp and biting, like sanious pus, the puerpera is more or less dangerously diseased. Decomposing clots or membranes, a forgotten piece of gauze, lend the lochia the foul odor of decomposition, even when the general condition of the puerpera is not disquieting. The other characteristics of the odor referred to indicate that the puerpera is suffering from one of the severer types of infection.

The lochia cruenta contain blood, shreds of membrane and decidua, and occasionally fetal remnants, vernix caseosa, lanugo, meconium, etc.

Lochia sanguinolenta contain blood in a state of solution, wound exudation, red and white blood-corpuscles, shreds of decidua in a state of fatty degeneration, mucus from the cervix and vagina, and microorganisms (Fig. 252).

Lochia alba are full of decidual cells—large mononucleated, irregular, round or spindle-shaped cells in process of degeneration, leukocytes, "lochiocytes," flat and cylindric epithelium, fat and débris from the uterus and the puerperal wounds, mucus, cholesterin crystals, and myriads of microorganisms (Fig. 254). In pathologic cases the *Trichomonas vaginalis* is found.

*The Bacteriology of the Lochia.*—Even in normal puerperæ the lochia are infectious, as the frequent finger infections of nurses and the navel infections of children show. Kehrer vaccinated puerperæ on the thigh with their own lochia and produced abscesses. Likewise, inoculations of animals with normal lochia, in many cases, produced sepsis and death. Döderlein found that the uterus, in the first few days after labor, was sterile in 83 per cent. of 250 cases examined. In the others were found the streptococcus, the staphylococcus, the gonococcus, and various saprophytes, aërobic and anaërobic. The vaginal lochia also contain these bacteria, and in greater frequency and number after the first day of the puerperium. The uterus, from the fourth to the seventh day, shows a bacterial flora, including the streptococcus pyogenes (Scheib). In the succeeding week the uterus gradually becomes aseptic. The most important bacteria found in the lochia are the streptococcus, the staphylococcus, and the bacillus coli communis. (See chapter on Puerperal Infection.)

In spite of very extensive study and experimentation, it is yet impossible to distinguish the pathogenic from the non-pathogenic streptococcus. Therefore the streptococcus, found in the vagina of gravidæ and puerperæ, must be regarded as capable of developing destructive qualities if the conditions for it are ripe.

Since there is no doubt of the presence of these dangerous germs in the vagina, why is it that women do not all develop fever or infection during the puerperium?

First, because the bacteria do not wander upward into the uterus, where the most extensive wounded surface lies, until the third or fourth day, and by this time the protecting granulation wall is formed in the endometrium. The stream of lochia from above tends to wash them out. The thick, squamous epithelium of the vagina also acts protectingly against an invasion by bacteria. If a careless examiner, or indeed any manipulation, breaks through this protecting wall of granulations, the infection of the underlying blood- and lymph-vessels is inevitable. Clinical experience has taught us the danger of such interference.

Second, because the bacteria are of weak virulence, or—and this is probably a complement to such a statement—the puerpera possesses natural immunities against infection. When her general health is broken,—as by hemorrhage or eclampsia, shock from operation,—or if the local resistances are lowered from severe injury, the bacteria can develop their virulence and invade her organism. Analogously, the bacterium coli communis in the intestine and the bacillus diphtheriæ in the mouth, may live for years without producing disease. Perhaps part of this immunity lies in the presence of other bacteria in the vagina, and part in the acid reaction of the secretion (after the sixth day): but most of it, probably, is in the active immune bodies of the living tissues themselves (Stoltz, Williams).

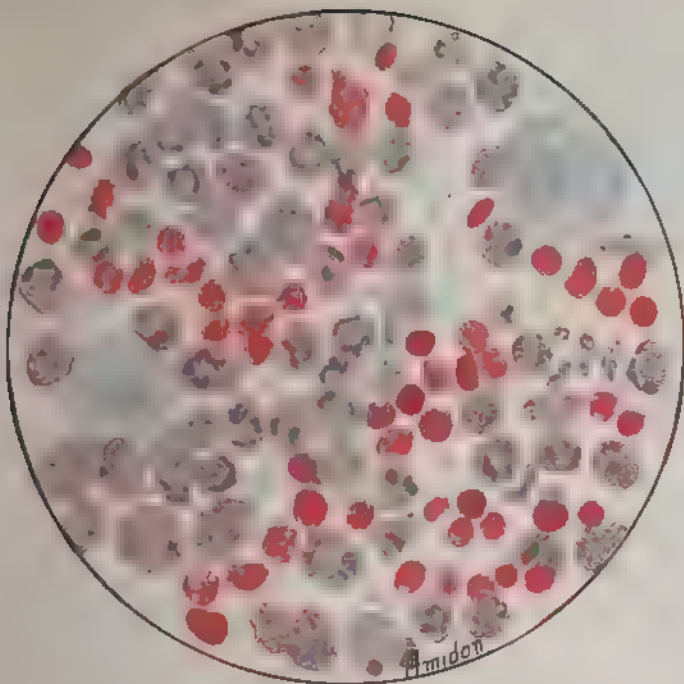


FIG. 252 LOCHIA. THIRD DAY.

1. Blood-cells numerous. 2. Healthy leukocytes, nuclei contracted and normal.
3. Few bacteria.

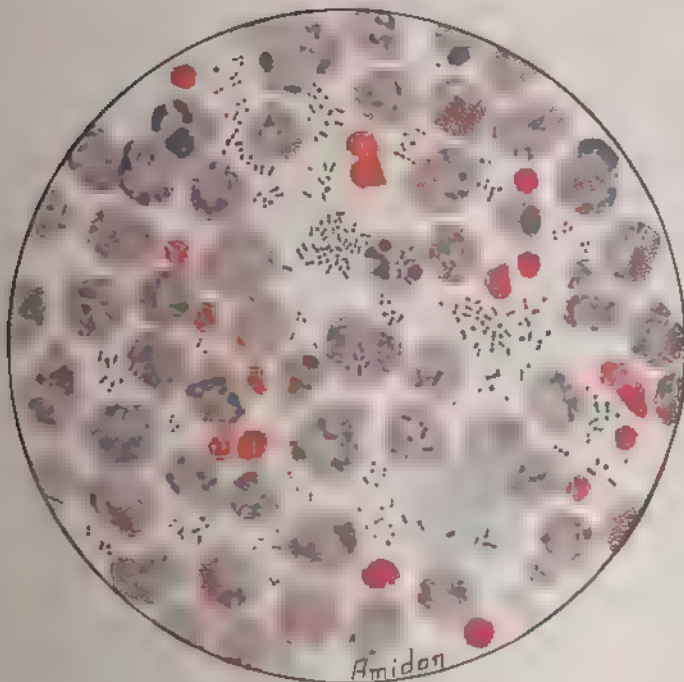


FIG. 253 —LOCHIA, FIFTH DAY

1. Bacteria in abundance—one kind principally. 2. Leukocytes swollen, nuclei swollen.
3. Phagocytes. 4. Blood-cells not so numerous.



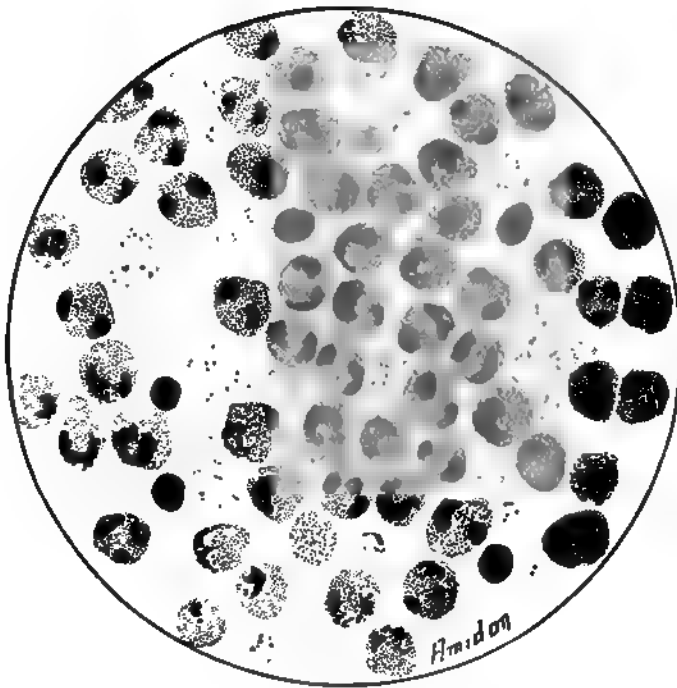


FIG. 254.—LOCHIA ALBA, EIGHTH DAY.  
1. Bacteria less numerous and pale staining, probably dead. 2. Leukocytes more numerous and more normal in appearance. 3. Blood less.



**The Quantity of the Lochia.**—Hippocrates estimated the amount of the lochia to be about 1300 gm.; later authors place it at about 500 gm., three-fourths of which is discharged in the first four days. Women who do not nurse their babies have more, nursing women less; indeed, in the latter, involution is faster and more perfect. These conditions are attended with increase of the lochia: Primiparity; young women; women who usually have profuse menses; twins; large placenta; operative deliveries, with bruising and injuries of the genitalia; retention of parts of placenta and membrane; too full meat diet; alcoholism; hemophilia; general atony. A strong, robust woman has more rapid reparative processes.

**Source of the Lochia.**—The lochia are very complex, containing the wound discharges, a serosanguineous exudate from all the puerperal wounds, from those of the dometrium, the lacerations of the cervix, indeed, of the whole parturient canal. A part of the flow comes from the utricular glands, the cervical glands, the vaginal and vulvar glandular organs.

The amount and quality of the lochia vary from day to day. If the patient rises up early, the lochia sanguinolenta continue longer or are more profuse. Sometimes the red lochia persist for several weeks, or they may reappear on the occasion of unusual exercise; or the lochia may cease as the result of disease (infection) or of obstruction to the flow. This almost always causes fever, which subsides when the drainage is reestablished. The normal changes in the color and consistence of the lochia are interfered with by infection, and one of our best diagnostic means is the investigation of the puerperal discharges. The lochia contain a leukocyte proteolytic ferment (Jochman).

**Involution.**—All the foregoing changes are part of the function of involution, the most prominent of which is the reduction in size of the uterus. The reduction in size of the uterus is subject to many variations. In women who do not nurse, the reduction in size is slower. Sepsis stops involution or slows it—an important sign. On the other hand, involution offers a barrier to infection—the shedding of the decidua resembles the cleansing of a granulating surface; the lochia carry off the germs. The tightly contracted uterus does not absorb bacteria nor toxins.

Involution varies in different women and in the same woman after different confinements. The rate of decrease is not even, the greatest being during the first ten days. Sometimes the process goes beyond the normal, the uterus at the tenth week being very small—superinvolved. This superinvolution is sometimes called lactation atrophy." It occurs only in women who nurse, and, in such cases, the periods do not reappear during lactation. The atrophy reaches its maximum about the fourth month. If nursing is stopped, the uterus is regenerated in six to eight weeks. This phenomenon is probably a conservative act of nature against too frequent pregnancies. If the nursing is continued too long, actual atrophy of the uterus may occur. When there are no general symptoms,—as pain in the back, nervous disturbances, anemia, weakness,—and if the uterus does not grow too small, the condition is not abnormal, and the uterus will regain its size after lactation ceases; sometimes, even before this. Occasionally (60 per cent.), about the third or fourth week, there is a slight return of bloody lochia. This is usually due to too much activity of the patient, and the blood comes from the placental site; perhaps a superficial clot is being exfoliated. A piece of placenta, thick membranes, subinvolution, infection of the endometrium, fibroids, and retroflexion are the commonest causes of profuse and abnormally long-continued lochia, or of a return of bloody discharge. An early return of the menses occurs in 43 per cent. of nursing women, but in only 26 per cent. are the periods regular. Intervals of weeks and months are noted, as are also great irregularities in amount and duration. If the women do not nurse, the menses usually return in six weeks and continue more or less regularly. The first menstruation after delivery is likely to be profuse.

**The Abdominal Walls.**—In many women the abdominal walls very slowly

and imperfectly regain their previous elasticity. In but a few the tonus is well preserved. A great deal depends on the amount of distention of the abdomen during gestation and the development of gas in the bowels after labor. Wearing tight corsets during pregnancy predisposes to weakness of the abdominal muscles. Attention to the bowels postpartum, and to the strengthening of the muscles, will aid in preventing what the women call "high stomach." Sometimes the belly is so weakened that the recti separate and the uterus comes to lie between them, a state which the women call "rupture," the scientific term being diastasis recti.

**Changes in the Breasts.**—These consist in the establishment of the function of lactation, whereby the woman is put in position to continue the nourishment of her offspring.

Nature has made woman an exception to the rule of other mammals. In her the secretion of milk does not begin until the second or third day, rarely on the first day after birth. In animals the milk is present in the glands the first few hours—even during labor. This delay is possibly an outgrowth of civilization, in that the function of reproduction is not allowed such full play as formerly, and lactation especially has been neglected for generations, resulting in hypoplasia of the glands.

The changes about to be described occur in the breasts after abortions from the fourth month on, as well as after labors at term. On the second day—or, as is usual in primiparæ, on the third day—the breasts grow harder, the veins become prominent, the whole organ fuller and heavier; the patient has the feeling that the secretion of milk is beginning and describes a prickling or burning sensation. Soon the swelling reaches a considerable degree, and the individual milk-ducts can be felt as hard strings—the lobes of the breasts as hard lumps. The gland is much fuller with blood and feels hot to the touch. Rarely, it becomes reddened and sometimes there is a bluish turgescence of the surface. The milk comes into the breasts much more stormily in primiparæ; they express it as "shooting in," and the distress caused is sometimes very severe.

The woman says the breasts feel like two hot weights on her chest, and if the little extension of the gland which sometimes lies in the axilla is involved, the patient keeps her arms outstretched in considerable discomfort, if not pain.

These phenomena are attended with a slight flow of milk from the breasts, even if the baby does not nurse. At each nursing the milk comes with greater force, but after twenty-four hours the process is not so active, though there may still be too much milk for a week, the binder being always more or less wet with it. Lesser degrees of activity of the breasts are common, even agalactia, absence of lactation, being observed. Even though the breasts show tumor, dolor, calor, and rubor, the phenomenon has nothing to do with inflammation; the patient has no temperature, or, at most, one-half degree F. There is nothing that could be called "milk fever."

In multiparæ the secretion begins earlier, sometimes even in the twelve hours after labor, and the breasts do not take on such sudden action, but lactation begins more gradually, and seldom do the breasts swell so that the skin is stretched over them tightly, as in primiparæ.

The enlargement of the breasts is not due wholly to milk. Only a small part of the milk is formed before the nursing, most being made while the child is sucking. The distention of the breasts is due to swelling of the gland-cells and lymphatic engorgement—both preparatory to the formation of milk. As soon as the child begins to nurse the gland-cells break down into fat-globules, the cells produce the milk plasma from the lymph in the distended lymphatics, and active secretion is established in a manner somewhat analogous to the action of the parotid gland. Completely established, the milk secretion becomes regular. The breasts fill up and are emptied in sequence, which is dependent largely upon training. If the child is put to the breast to nurse at regular intervals, the organ quickly accom-

odates itself to the hours, and one notices that, when the usual sequence is interrupted, the breast will begin to functionate at the proper time.

The first milk that comes resembles the secretion that may be pressed out of the nipple in the latter part of pregnancy; it is clear or only slightly cloudy, sticky, contains yellow streaks, and is called "*colostrum*."

The colostrum under the microscope is seen to be made up of fat-globules, a watery fluid, and the so-called colostrum corpuscles (Fig. 255). The fat-globules are often adherent by a thin substance which is visible after staining with certain reagents. The colostrum corpuscles are round, ovoid, or stellate cells which sometimes show amoeboid movement and have one to three nuclei, which color with ammonia carmin. They contain numerous fine fat-globules. Where they come from has been disputed—they are believed to be changed gland epithelium or leucocytes, mast cells which have gathered up fat-globules. Since they are phagocytic they probably are not epithelial. They remain four to six days, and reappear if there is stasis or inflammation. In addition, lymphocytes are found, more or less full of fat drops; indeed, they may be balled together so that they can hardly be recognized as white blood-cells. Colostrum contains very little if any casein, but nearly 15 per cent. lactalbumin and lactoglobulin, with much fat. It, therefore, has a slightly cathartic action on the new-born babe. One sometimes finds colostrum in the breasts during menstruation, sexual excitement, always during pregnancy, early lactation, and during the weaning process. The colostrum at this time helps the resorption of the milk. It has a proteolytic ferment (Jochannan).

*Human milk* is an opaque, slightly yellowish or bluish-white liquid, with a characteristic odor and sweetish taste. Specific gravity varies from 1026 to 1036; is neutral or alkaline; its freezing-point is  $\Delta = -0.49$  to  $-0.63$ . Microscopically, one sees innumerable fine fat-droplets, alike in size if the milk is of good quality, and occasionally a glandular epithelial cell or a leukocyte.

It is still unsettled whether there is a membrane of casein around the fat-globules or not. The globules float in a thin, almost transparent, serum which contains albumin. Sometimes bacteria are present.

The composition of human milk varies from day to day and from hour to hour. It contains  $87\frac{1}{2}$  per cent. water,  $12\frac{1}{2}$  per cent. solids, of which 6.21 per cent. is milk-sugar, 3.78 per cent. fat, 2.29 per cent. proteids (lactoglobulin, 1.26 per cent., and casein, 1.03 per cent.), and 0.71 per cent. salts (König). Of these constituents, the fat is subject to the greatest variations, the proteids less, while most constant are the sugar and salts. In round figures, milk has 88 per cent. water, 2 per cent. proteids, 4 per cent. fat, and 6 per cent. sugar. Holt says the sugar is nearer  $7\frac{1}{2}$  per cent., and he emphasizes the iron content, 1.7 mg. per liter. The fat of the milk comes from the epithelium lining the acini and alveoli. When the proper stimulus reaches these cells, which are low, cuboid, with one nucleus, they enlarge, the nucleus divides in a vertical direction, the cell becomes columnar, the protoplasm shows fat-globules, especially near the lumen of the acinus, and finally the cell membrane breaks, setting free the formed fat. After this process is repeated several times the cell itself is cast off, its place being taken by others made by lateral proliferation (Figs. 257 and 258). It is possible, but not proved, that the epithelia can select fat out of the circulating blood, or make it from the carbohydrates ever present in the gland. The casein, since it does not exist in the blood, must be made in the gland itself, as also must be milk-sugar or lactose. Bottazzi found a phosphoglycoprotein in the breast, and believes that through the splitting of this, casein and lactose result. If there is stasis of milk in the breasts, lactose appears in the urine.

The fluid parts of the blood do not reach the milk by filtration or exudation, but are separated from the blood by special secretive action of the glandular epithelium. One must accord the epithelium the most important function of making the milk.

Enzymes, or living ferments, are found in the milk and give it vital sustaining



qualities, which are not to be discovered or imitated by the finest chemist. Breast milk is a living secretion, and contains all the food requirements for the infant, ready for immediate absorption, vitamins and also the antibodies to infect

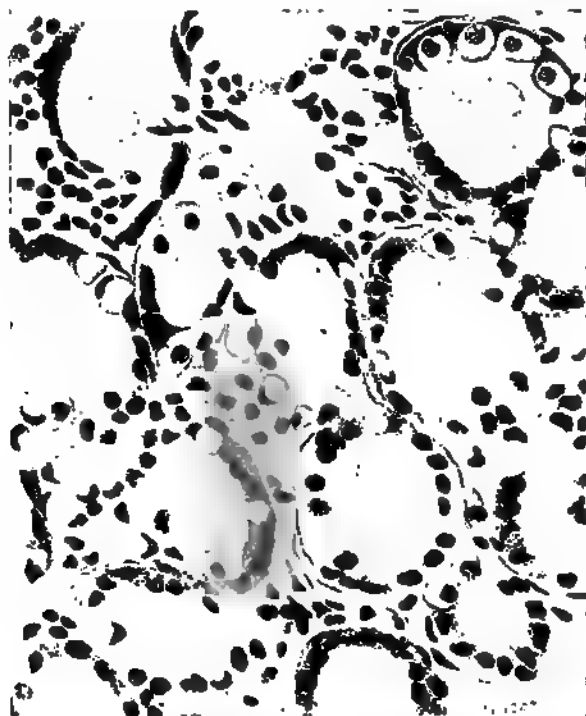


FIG. 257.—FUNCTIONATING HUMAN BREAST.

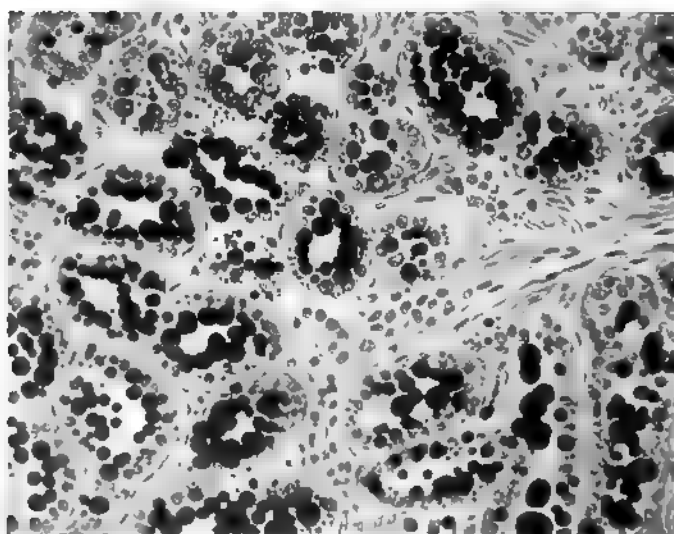


FIG. 258.—MAMMARY GLAND—LACTATING—STAINED WITH ORSIID ACID (specimen loaned by Dr. Gideon W.

It is a clinically demonstrated fact that breast-fed children resist infection of all kinds infinitely better than those fed artificially. The author has seen such children brought to the hospital in collapse, revive after a few breast-feedings as if a st

lial had been administered. Wassermann has proved that the blood-serum of ast-fed children has stronger bactericidal power than that of those fed from the tle. The quantity and quality of the milk vary:

First, with the individual—nervous women are not as good wet-nurses as the gmatic.

Second, with the race—Japanese, Jews, Swedes, Turks, gypsies, and negresses ally have abundant milk.

Third, with development of the body—a small, thin woman usually gives e milk than a large, muscular, or fat woman; the same rule holding good with s. Nor does the size of the gland have much effect. The gland-lobes may be in amount than the fat of the organ, though usually a well-developed breast nipple presage a good milk supply.

Fourth, nutrition of the patient, to a certain degree—a woman in good th is more likely to give sufficient milk than a sickly mother, but, occasionally, sees a tuberculous mother with a fat, healthy baby.

Fifth, age of the patient. This has very little influence, though, before the of eighteen and after forty, the milk is likely to suffer both in quality and quantity.

Sixth, toward the end of lactation the milk gets poor in quality and less in ntity, though there are exceptions.

Seventh, the milk of the two breasts varies in quantity and quality, and from to day, and at different times of the day, and during a single nursing. The teids, fat, and sugar increase in amount with the emptying of the breasts.

Eighth, hunger decreases the amount of the milk; fat, casein, and sugar rease, while the amount of albumin increases. These facts were found by aisine during the siege of Paris.

Ninth, emotions may alter quantity and quality—it is said that extreme tional shock may so alter the milk that it will give the child colic, diarrhea, or n convulsions; that nervous shock may produce agalactia is well known.

Tenth, menstruation sometimes has a distinct effect on the nursing child—it y have colic, or cry a great deal, and may pass green stools, vomit, or have diar- a; though, chemically, one can find no alteration in the milk. The changes last y a short time.

Eleventh, *pregnancy*—the milk gradually dries up, after becoming more ery. Very often the nursing mother observes a change in the nutrition of the nt and ascribes the same to the advent of a new pregnancy.

Twelfth, *drugs* often reappear in the milk. This has been known since pocrates, in connection with cathartics. One may, in order to purge the infant, e the mother the cathartic. Alcohol is said also to pass over, and cases are cited re the baby got drunk. Opium has caused narcosis of forty-three hours in the y. Iron, arsenic, iodine, lead, and mercury are well known to pass over. Sal- an may thus be used for the treatment of mother and babe.

Brieger has shown that immunizing doses of tetanus antitoxin pass over to the nt. The writer allowed a woman with diphtheria, who had large doses of anti- n, to nurse her infant. The child did not take diphtheria, though Hofbauer ns that the diphtheria antitoxin is not transmitted to the child. Vaccinia is not eved to pass over. The only drug which has any effect on the amount of the e secreted is iodid of potash. It limits the output.

Thirteenth, disease has an important effect on the milk. Diarrheas cause a inution; in cholera, sometimes complete absence. In sepsis the milk some- s dries up, which is a bad omen. Bacteria can pass into the milk in disease hrer). Tuberculosis, anthrax, may pass over without any demonstrable change he gland. In mastitis the milk may contain cocci and pus.

Fourteenth, irritation of the nipples causes an increase of the secretion. This e monstrated clinically in many ways—*e. g.*, by placing the baby to the breast

early, the milk comes earlier, and by using the breast-pump too much to "relieve" the breasts, more milk is produced. It is possible to start lactation in a non-puerperal woman, even in young girls, by properly stimulating the breasts. Massage of the breasts and cold baths increase the milk supply.

Fifteenth, certain foods are said to increase the secretion, as tomatoes, oysters, and gruels. My experience with them is negative. Liquids, especially cows' milk, increase the amount of milk, and a rich supply of proteids in the diet seems to augment the fat content. Overfeeding, however, in the author's experience, only occasionally improves the nursing, and then, temporarily. Later, the mother puts on fat and the breasts dry up. If there is no gland tissue in the breast, no amount of stimulation will cause it to secrete.

Certain foods are said to alter the milk to the disturbance of the child—e. g., strawberries, tomatoes, beans, and acid fruits. It does seem that idiosyncracies, possessed by the mother, also become evident in her offspring.

Sixteenth, multiparæ usually have more milk than primiparæ, and women, after normal labor, are less likely to have disturbed lactation than those who have had difficult, operative deliveries, especially if attended with great loss of blood.

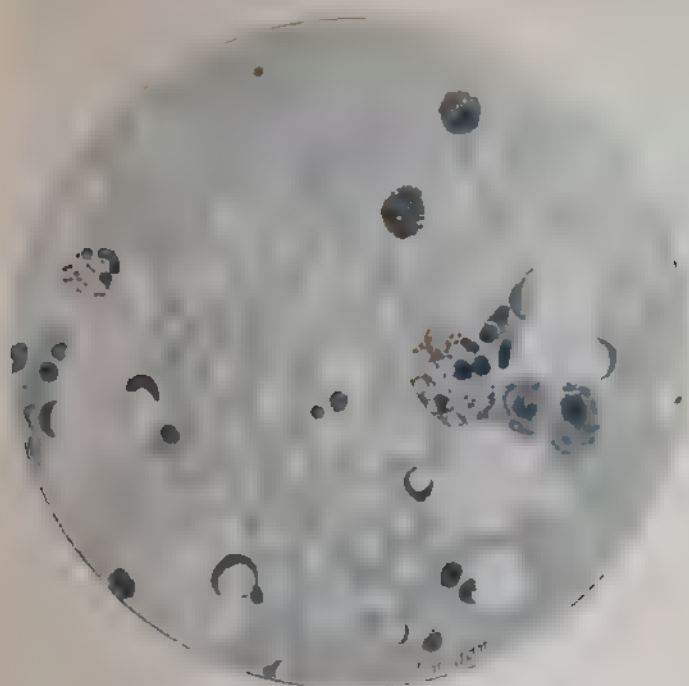
Seventeenth, the amount of milk varies with the demand. Ordinarily the breasts give 600 to 800 gm. per day, depending on the needs of the nursling, but Budin has recorded cases where a wet-nurse produced 2500 to 2800 gm. of milk per day, for a long period, without injury.

If the nursing is interrupted from any cause, it may be resumed, providing the interval is not too long. The author has seen the secretion of milk return after an absence of five weeks, and cases are recorded of its return after months.

Lactation has a not unimportant bearing on the general condition of the woman. A certain amount of blood and fat must be eliminated after pregnancy. Part of these go in the lochia, part in the excreta, and part in the milk. If the last is not excreted, the other organs must remove the excess and, according to Kehrler, congestion of the genitalia is likely to occur. It is a fact that, when the patient does not nurse, the lochia are increased, and the involution of the uterus is delayed, but this is generally explained by the absence of the reflex irritation which nursing causes on the uterus. The act of nursing causes uterine contractions in the early puerperium, which are a prominent symptom, as "after-pains," and these favor the rapid involution of the uterus. Positive observations are not on record, but, in general, it may be said that a woman recovers better from her labor if she nurses her offspring. Lehman finds slight statistical indications that the neglect of lactation favors the development of carcinoma of the breast.

#### LITERATURE

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Leukocyte

Colostrum  
corpuscle

Epithelial  
cell

FIG. 255. COLOSTRUM.

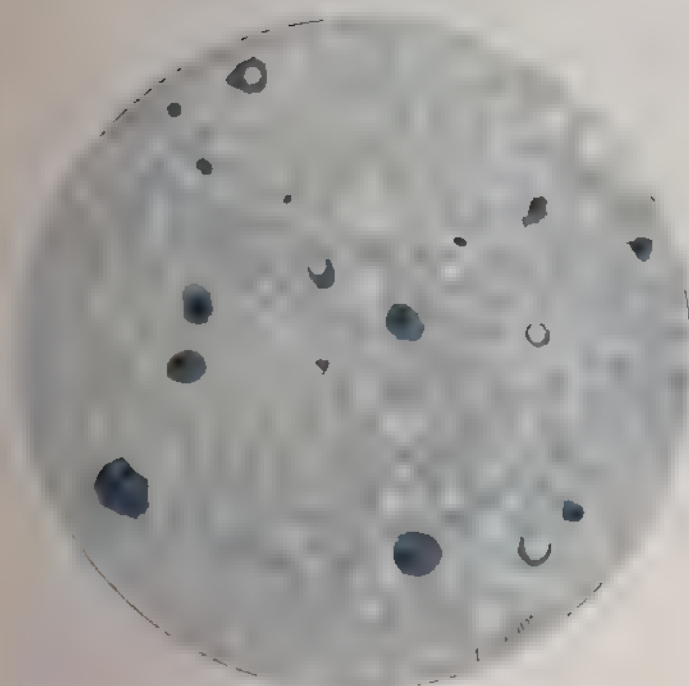


FIG. 256. MILK.



## CHAPTER XV

### GENERAL CHANGES IN THE PUERPERIUM

It is surprising how little the general condition of the woman is affected by such a severe storm as is even a normal labor. In the absence of infection, most women feel quite well during the puerperal period. The soreness of the genitalia, due to the vulvar wounds, disappears in a few days, the soreness of the muscles subsides, and, even after a few hours, the patient feels rested from the severe exertion of delivery. Women unused to exertion recover less quickly from the strain. After a difficult operative delivery, however, and after a severe hemorrhage, we find the symptoms that would naturally go with such conditions, and the occurrence of surgical shock must also be mentioned. A multipara is likely to be annoyed by after-pains. These are painful uterine contractions which recur more or less regularly for one, two, three, or even six days. The contractions occur especially when the child nurses, a reflex or, perhaps, a mamma hormone going to the uterus from the breasts; also when the uterus is massaged, but most markedly when pieces of membrane, of placenta, or blood-clots have been left in the uterus. Women who have had endometritis, metritis, frequent abortion, rapidly successive labors, overdistention of the uterus by twins, polyhydramnion, or very quick labors, are likely to suffer more with after-pains. Primiparae, because the uterus remains in a state of good tonus, are less likely to suffer with them. If these painful contractions appear after they have once ceased, it is indicative of something wrong in the uterus—either infection or retained secundines, a fibroid, etc.

**The Nervous System.**—Puerperae are more sensitive to irritations, a fact which was known to the Romans, and they placed a sign before her door, so that she was not disturbed—even by the tax collector. The reflex excitability is increased. Recent investigations of the knee-jerk show that in pregnancy this reflex is more active than usual, that it is most active in labor at the height of a pain, while during the puerperium the excitability gradually passes away. Puerperae hear more acutely and are more sensitive to light and odors. Though many writers, and even nurses, believe that a nervous shock can cause fever, the author has never observed an unequivocal case where such a severe emotional storm has raised the patient's temperature. (See chapter on Puerperal Infection.)

**The Temperature.**—Variations in the temperature of puerperal women form an important index of her health, and, together with the pulse, give us reliable information. Although attended by severe muscular exertion, labor does not, as a rule, raise the temperature more than one-half degree. If the labor terminates in the afternoon, the usual rise, at this time, may be exaggerated; but in normal cases, the parturient's temperature should not go above 100.2° F. Even this makes one suspicious of infection. The so-called "physiologic chill" is, in the author's opinion, the result of the flooding of the system with toxins or bacteria from the puerperal wounds, or possibly alien proteids, as was told on p. 131. The temperature may rise one-half degree after labor, but falls to the normal within twelve hours, and then shows the physiologic diurnal variations, but these do not exceed 98.6° F. Many authorities assert that a puerperal woman may normally have fever. Ling considers every rise above 101.1° F. pathologic; Winckel places the limit at 100.7° F.; Boxall, of London, at 100° F.; Williams, at 100.4° F. It is, to a great extent, arbitrary. My own experience is that, if the temperature rises above

99.5° F., there is almost always some cause for it—usually, a mild infection. This, then,—99.5° F.,—is given as the limit for a puerperium which may be called normal, but it is not meant that a woman showing a slightly higher fever must be very ill or in danger. In such cases one is warned to more careful asepsis in the daily technic of delivery and a painstaking study into the cause of the elevation in each individual case.

Primiparæ show higher temperatures and greater fluctuations than multiparæ, because in them there are more wounds and greater possibilities for the absorption of toxins. After hard operative deliveries, after many internal examinations, the temperature is often higher and more labile.

*There is no such thing as "milk fever"!* Formerly, in the non-antiseptic era, almost every puerpera had fever on the third day. Since at this time the breasts become large and hard, the fever was ascribed to the violent coming of the milk, and the real cause, the infection of the genitalia, was overlooked. With the advent of antisepsis there has been a great decrease in this so-called "milk fever," and large numbers of the best authorities deny its existence. Jaggard said he had never seen a case where there was fever and no other cause to be found than simply the coming of the milk. I have seen primiparæ with the breasts standing out hard and firm, the axillary lobe of the gland so swollen that the patient had to keep the arms from the sides, and yet the temperature was 98.6° F. Infection of the breasts is another thing. "Milk fever" is a misnomer that should be abolished from obstetrics. It too often forms the cover for severe puerperal infections, and many women have lost their lives because of neglect of the real disease.

The reason usually given that the puerperal woman should have some fever is this: The products of the regressive metamorphosis of the uterus and all the genitalia being absorbed, must be oxidized. This increased oxidation causes the increase in the body heat. But nature, by increasing the perspiration and other excretions, keeps the temperature nearly normal. The slight rise of temperature right after delivery is probably a mild infection. The older writers called it fibrin ferment fever.

The temperature of the puerperal woman is subject to fluctuations on slighter causes as compared with the non-puerperal woman.

Constipation is said to give rise to temperature, which goes down when the bowels are emptied. This fever is probably due to obstruction to the flow of lochia, which is overcome when the rectum is emptied, but may be due to absorption from the intestine. It is safest, as soon as your puerperæ have fever, to think of infection first. A full bladder may act similarly, but it is wise to bear in mind the frequency of ureteropyelitis in puerperio. While fever may arise from the bowels, as from enteritis, I have never been fully convinced that constipation itself will cause it.

**The Pulse.**—In the second stage of labor the pulse is strong, rapid, perhaps irregular; but during the third stage it calms down and is normal throughout this time, unless there is a severe hemorrhage, when it becomes small and fast. Immediately after labor the pulse is soft; soon it has a high tension, especially in multiparæ, but the blood-pressure then sinks slowly to below normal or about normal.

A very high tension slow pulse must be regarded as a warning of eclampsia. In general, the pulse during the puerperium runs from 68 to 80, which is about normal, though higher rates are sometimes found, even in healthy women.

A peculiar phenomenon is sometimes observed in healthy puerperæ. The pulse-rate may be as low as 40 a minute, and some observers have found 30, but this is very rare. It occurs after labors at term more than after early abortions; in multiparæ more often than in primiparæ; in lean oftener than fat women. The author has found a pulse of below 60 in only 10 per cent. of his cases. Other authors give 16.2 per cent. (Hemey's) and 63 per cent. (Olshausen). The cause is not known. Lynch gives the literature. There are many theories, of which the most plausible are: Fehling's—the sudden diminution of the intra-abdominal tension

ritates the *vagus* reflexly; Schröder's—the heart; which hypertrophies during pregnancy, now need not work so hard; Olshausen's—the fat, which is absorbed from the uterus, slows the heart, that it is an evidence of vagotonia, as may be proved by pressure on the eyeball, which will make the pulse still slower. Further, the horizontal position, the quiet of the patient, the less amount of food, the great secretion of liquid in milk, lochia, sweat, etc., may conduce to the slow pulse. It is of great prognostic significance. A slow pulse indicates that everything is going along nicely.

A very rapid pulse in the puerperium, in the absence of fever, points to hemorrhage, recovery from severe hemorrhage, or some heart disease. Not seldom a rapid pulse draws attention to the condition of the heart, but one must be careful in the diagnosis of heart disease during pregnancy and the puerperium, because murmurs are common (70 per cent.), and a displaced heart simulates hypertrophy. The pulse is more labile during the puerperium than the temperature. It warns much quicker of the advent of sepsis or other puerperal complication, but is less liable. It fluctuates with the after-pains and with any little excitement—as sitters and nursing the baby. The usual relation between temperature and pulse obtains here as elsewhere.

**The Blood.**—There is a decrease in the amount of blood (Sengel), which had increased during pregnancy, an evidence of the loss during labor and especially if delivery was accompanied by much hemorrhage. The hemoglobin is disproportionately reduced. The lochia, sweat, and other excreta tend to impoverish the blood in the first week, so that in the first days after labor there may be a decrease both reds and whites. During labor, the leukocyte count varies from 9000 to 20,000, with an average of 18,000, the increase being in the polymorphonuclear neutrophiles. Eosinophiles are often absent. The reds vary from 4,000,000 to 5,500,000. After labor the leukocytosis rapidly disappears, even within twenty-four hours, but usually it requires several days for the count to come down to the normal limits—10,000 to 15,000, which is somewhat higher than in the non-puerperal state. The normal proportion of the various whites is:

Neutrophiles . . . . .	60 to 75 per cent.
Lymphocytes . . . . .	25 per cent.
Eosinophiles . . . . .	2 to 5 per cent.

These proportions vary from day to day. About the fifth day one occasionally observes a slight eosinophilia, which is more marked after the birth of twins, of asphyxiated fetuses, and in gonorrheal cases. Infection alters the blood-picture. (See p. 876.)

The **respiration** is not much altered in frequency, but responds more readily to disturbances. The chest being free, expands more easily than during pregnancy, the type of breathing being costal and diaphragmatic. The vital capacity is increased after the third day. On percussion one finds a deeper resonance. The heart dulness sinks a little.

**The Skin.**—All the functions of the skin are more active, the sweat-glands particularly. After labor, when the patient is well covered up, she breaks out with a full, warm sweat, but this is rarely so profuse as to require a change of bed-linen. She is favored by the warm covers and the administration of warm drinks. That there is a sweating peculiar to puerpera is not true, but the perspiration has a peculiar odor, which varies in health and disease. During the lying-in there is a tendency to perspiration, especially in sleep, but it is less in the latter days, probably cause of the establishment of the milk secretion and the free lochia.

The laity have great fear that the patient takes cold at this time. This is the growth of the old belief that puerperal fever comes from catching cold, a view



still held among the midwives, and in their practice it is not unusual to find the windows closed and the patient covered with heavy blankets, even in summer.

Ahlfeld says that there is some connection between the appearance of the sweat and the contraction and retraction of the uterus after labor.

**The Kidneys and Urinary Apparatus.**—Relieved suddenly from the increased intra-abdominal pressure by the delivery of the child, the kidneys become active. In the third stage it is not rare to find the bladder full and even overfilled, making an obstacle to the delivery of the placenta.

In the first twelve hours there is usually retention of urine, which sometimes may be enormous and cause *ischuria paradoxa*. This is due to the lack of elasticity of the bladder, inability to urinate in the horizontal position, the swelling of the vulva and urethra, kinking of the urethra (Olshausen), reflex spasm of the sphincter from stitches in the perineum, and injury to the bladder trigonum and urethral orifice, with edema. Still, quite a few puerperæ pass urine spontaneously. In many cases it is necessary to use the catheter. As a rule, patients pass urine three times daily, much less often than in the later months of pregnancy.

Cystoscopic examination of the bladder after labor shows the effect of the bruising sustained during the expulsion of the child. The trigonum and urethral orifice are edematous and strewn with minute blood extravasations. The epithelium desquamates and lies on the mucous membrane as a grayish film. After prolonged deliveries and hard operations, the bladder-wall is much crushed, and in the cystoscope we see the above effects much more marked (Fig. 259). The ureteral orifices are not easily found, but the ureters are very easily palpable, being usually somewhat enlarged. The laceration of the urogenital septum, and of the connective tissue around the base of the bladder, allows the anterior wall of the vagina to prolapse, carrying the urethra and neck of the bladder with it.

The urine collected just after delivery frequently (40 per cent.) contains a little albumin, white blood-corpuscles, a few reds, and scattered hyaline casts. In twelve hours the latter disappear. The amount of urine for the first eight days is 300 to 400 c.c. more than that of the non-pregnant woman, but is not much more than that of the pregnant woman in the latter months (Kehrer).

The specific gravity varies from 1010 to 1025, according to the amount of urine. The urea varies from 2.6 per cent. to 1.6 per cent., being highest on the third day, the excess being ascribable to the increased metabolism of lactation—the change of the albuminoids into fat. It is, therefore, less in women who do not nurse. The proportion of salts, phosphates, and sulphates does not vary much from the normal—perhaps the salt output is increased.

Milk-sugar occurs in 80 per cent. of puerperal urines (von Noorden). It is derived from the breasts. Blot first called attention to this physiologic lactosuria. It is greatest during the establishment of lactation, absent during its proper functioning, and appears again during the weaning process. The average is 0.2 per cent., but this may be increased to 1 per cent. by feeding with albuminoids and carbohydrates.

Peptone has been found in the urine by Fischel from the second to the tenth day, and is ascribed to the absorption of products of albuminoid degeneration going on in the uterus. Albuminuria occurs in 40 per cent. of the cases of labor, but this disappears before the third day. If it does not, or if albumin reappears, its cause must be sought out. Nephritis, pyelitis, ureteritis, cystitis, post-anesthetic effects, eclampsia, and sepsis must be considered. To avoid confusion from the admixture of lochia, only catheterized specimens may be used.

Lactic acid, acetone, pepsin, and toxins have been found in the urine of puerpere. Creatin, discovered by Shaffer in the urine postpartum, is believed by Mellanby to be due to some unusual metabolism of nutrient material during the development of the fetus and the establishment of lactation.



FIG 250 —BLADDER THREE HOURS AFTER DELIVERY.  
Note edema of trigonum and hemorrhages.

**The Intestinal Tract.**—The puerperæ are very thirsty and drink much, but appetite usually is poor for the first three days. Loss of fluids during labor, and the lochia, urine, and sweat, explains the thirst. After labor, the belly is flat, and slightly concave, but soon a moderate tympany appears. In thin women the perineal tumor, the large and small intestines, with their peristalsis, the liver, spleen, and kidneys are very easily palpable, and one may use the opportunity for investigation of these organs.

A moderate tympany is normal in the puerperium; it is due to slight intestinal paresis, and accompanies the usual constipation. Rarely do the bowels move spontaneously in the first few days of the puerperium. The causes of the obstipation are: The bowels usually have been emptied by cathartics before labor; the woman is little, and the excretion of fluids is so rapid that the intestinal contents dry up; the abdominal and perineal muscles, because of overstretching, cannot do their work; a patient usually has difficulty in defecating while lying on the back; and pain in the parts may inhibit the action.

Older writers believed that constipation could cause puerperal infection. That constipation alone may cause fever I have some doubts, but in these cases the fever would come from the intestinal canal, not from the genitalia. A brisk purge may be followed by a fall of temperature in a case of real puerperal infection, and one may be misguided into ascribing the fever to the intestines, when, in reality, the purge simply stirred up the pelvic circulation, emptied the lower bowel, provided good drainage for the lochia, and perhaps increased the local and general leukocytosis so that the infection was taken care of. The author does not believe that constipation or errors of diet (another popular fancy and fallacy) can cause puerperal infection.

The **weight** of the patient undergoes marked changes in the first months after labor. According to Gassner, the average weight of 238 women, on the day after labor, was 124 pounds. In the first two weeks they lost about 9 pounds, or 8 per cent. of their weight—Baumm, 6.58 per cent. The loss is greater in multiparæ, greater in large women, and after full term than premature labor, and greater after twins. This loss of weight is due to the moderate amount of food taken and the great amount of excreta—the sweat, the urine, but especially the lochia and the milk. The women look thin, pale, and washed out after getting up, and need a tonic diet. The weight is regained in four to six weeks, many women owing it on excessive fat. Nowadays, since we do not starve the women so much in the puerperium, these losses are not so marked, but the custom of feeding puerperæ very lightly still exists in many places.

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divis, milder degrees of pelvic distortion cause abnormalities in the mechanism of labor which not seldom cost the life of the mother or the babe, and often leave serious injury to both.

The acute infectious diseases—scarlatina, diphtheria, anterior poliomyelitis, etc.—not seldom leave permanent traces on the child, as nephritis, hepatitis, disease of the endocrine glands, and, in the last instance, paralysis, with shortening of the legs and consequent distortion of the pelvis.

These few examples are given to indicate the scope of prophylaxis in early life, from an obstetric point of view, and much can be done by a wise hygiene to preserve a growing girl from the evils of disease, environment, and heredity.

### PUBERTY

At this time, when mighty changes are going on in the internal and external genitalia, the foundation of permanent disease may be laid. It is beyond question that the crowding of the child's mind with studies and accomplishments, the premature social duties, together with inappropriate reading and company, and a lack of outdoor exercise and sports, tend to develop the mind at the expense of the body, particularly the sexual organs, which require so much of the girl's vitality at this period. Dysmenorrhea, hypoplasia of the uterus, later, chlorosis, are some of the results of these evils. Early womanhood also requires proper hygienic conduct if one wishes to develop a healthy nervous system and a normal reproductive function. Of transcendent importance is the proper instruction of the growing girl in the principles of sex and reproduction. Only in this way will it be possible to save a girl from ignorantly performing secret practices, *e. g.*, masturbation, to restrict the spread of venereal disease, the number of illegitimate births and criminal abortions. It is impossible to go deeper into this important subject here, but that the obstetrician is concerned in this matter goes without saying, and by wise counsel, at this particular time, he may save the girl from permanent invalidism, even from death in childbirth (Surbled).

### MENSTRUATION

Unfortunately, most women cannot take sufficient care of themselves during their monthly illness, but many who could do so are very careless with themselves. Examples of great neglect are common. Immoderate dancing, exposure to cold with thin clothes, sexual excitement, hot baths taken to bring on the period, all use catarrhal conditions of the uterus, which predispose to abortion, adherent placenta, and postpartum hemorrhage.

### THE HUSBAND

The part played by the husband in obstetric complications has never been properly noticed. If he is unusually large and heavy boned, he may procreate children too large for his wife to bear. Venereal disease communicated to the wife is so common that obstetricians reckon with it all the time. Under this heading may be mentioned the local inflammations of the female urinary tract, cystitis, ureteritis, pyelitis, surgical kidney; vulvitis, endometritis, with adherent placenta, postpartum hemorrhage, subinvolution, etc.; pyosalpinx with gonorrheal and streptococcal (often fatal) peritonitis; syphilitic macerated fetus, with maternal hemophilic tendencies; gonorrheal ophthalmia of the new-born, and other fetal disease. These need only to be indicated to show that the husband is directly concerned in our discussion.

Too frequent intercourse during pregnancy often causes abortion, premature labor, and even abruptio placentæ. One important fact, and it will be again repeated, is that coitus in the latter weeks of pregnancy may cause infection of the uterus, which shows itself during and after delivery as a sometimes fatal puerperal fever.

## CHAPTER XVII

### HYGIENE OF PREGNANCY

**WOMEN** call the doctor and engage him for their confinement earlier now than formerly, earlier among the better classes than the poorer, earlier in the city than the country, earlier in the United States than in most other lands. Numerous advantages arise from this, in that it may enable the doctor to learn the traits or constitution of his patient, watch for any symptoms of disease, and prepare her properly for the labor. It, therefore, should be encouraged in practice.

Many and varied questions will be asked of the accoucheur, and it will be found convenient to supply each patient with a folder containing instructions for her to follow and other common information. In a general way the gravida should not change her usual mode of life unless the physician knows that some of her habits are bad.

**Dress.**—The dress should be simple and warm. All the clothes should hang from the shoulders by suspenders or corset-waist, and heavy skirts not worn; better, warm drawers, closed, to prevent infection from street dust.

Low-heeled shoes with broad toes are best. The pregnant woman throws her head and shoulders back, in order to keep her balance. This makes an angle in the small of the back (see Fig. 133, p. 113) and gives the patient a peculiar gait, which did not escape the eye of Shakespeare, who called it the "pride of pregnancy." Elevation of the heels throws the body still more forward; the woman must throw head and shoulders further back, which causes pain in the loins and stretching of the abdomen. Flat feet exaggerate these pains and aches and should be corrected.

There should be no circular constriction at any part of the body, which means that corsets, tight waistbands, round garters, may not be worn. The Latin term for the condition of pregnancy was "incincta," without a girdle, and had reference to the custom of laying off the girdle as soon as pregnancy was determined. In multiparæ with a tendency to pendulous abdomen, and in most primiparæ toward the end of pregnancy, a light-weight, woven abdominal supporter will be found very comfortable. Most women prefer one of the maternity waists on the market. The Patterson supporter and the Kabo Maternity Corset are the best types. The corset is particularly injurious during pregnancy, because it forces the uterus and child down into the pelvis and against the lower abdominal wall, causing congestion of the pelvic veins and weakness of the abdominal muscles. Too tight corsets also, by restraining the expansion of the uterus, cause deformities of the child; for example, club-foot, wry-neck. Women who wish to conceal pregnancy by tight lacing may do themselves or the fetus even fatal damage.

**Diet.**—Simple, not strict, rules govern the diet. The amount of meat and broths should be small—not more than four ounces of meat or its equivalent in fish or eggs per day. Starches fried in fat and rich pastry should be avoided. Cereals, vegetables, and fruits should be eaten, especially fruit, to loosen the bowels. Water is taken freely, at least five full glasses daily—sterilized or filtered. Milk and, especially, buttermilk are commended. Alcohol is to be forbidden, first, because of the danger, exaggerated during pregnancy, of contracting the liquor habit; second, because of its demonstrable bad effect on the offspring, a fact which was known in Biblical times. Samson's mother abstained from wine during her pregnancy. A child begotten by a drunken father may be dull, stupid, or diseased, an observation made by Diogenes.

Fat women may restrict the liquids, but never so much that the daily amount of urine is reduced below 32 ounces, and a moderate general decrease of the diet permissible for them.

Coffee in moderate amounts is not forbidden. Some popular books advise a special diet to reduce the bone salts of the fetus—a pernicious recommendation, because the mother's health will suffer before the infant is affected, and in all probability fetal rickets would result if an effect were possible.

In general, a woman's ordinary habits need be little disturbed. She should not overeat, thinking she must feed two. Special rules govern the diet in women who have contracted pelves (Prochownik's diet), renal disease, or diabetes.

**The Bowels.**—Constipation is the rule during pregnancy, and, if neglected, may lead to most serious consequences. A long-standing habit cannot be cured at this time, wherefore drugs must, usually, be resorted to. The following is the treatment resorted to by the author:

First, the patient should make it an unailing habit to go to stool at a certain hour each day. The best time is shortly after breakfast. Should no movement occur—and straining is not permitted—the action of the rectum may be provoked by glycerin suppository or an enema. A desire to go to stool at any time must not be resisted. A sufficient amount of exercise must be taken. Abdominal massage is not permissible during gestation.

Second, every morning just after rising and every evening just before retiring the patient should drink a glass of cool water and eat some fruit—an apple or orange. Between meals water is to be drunk freely.

Third, her diet should contain fruit and vegetables in abundance, especially wheat, peas, beans, barley, tomatoes, corn, bran bread, and foods of this kind. They give something for the bowels to act on, but one cannot use so much of them as in the non-pregnant state. Tea is forbidden, but coffee in moderate amount allowed. Prunes, figs, and dates are to be eaten, with care to chew them very fine, as they may cause indigestion. A little system in this helps a great deal, probably by suggestion. Let the patient begin with one prune a day, then one more each day up to ten or fifteen, gradually decreasing the number as the need disappears. Agar is being given lately, and certain foods which contain flaxseed.

Fourth, let the patient, every night before retiring, inject into the rectum from 6 ounces of ordinary olive oil, leaving it there all night. In cases of spastic constipation this is a valuable remedy.

Fifth, drugs are withheld, as far as possible, and active cathartics entirely. Cascara, in bitter extract, administered in capsules, gives the best results, the dose being increased gradually and decreased as the desired effect is obtained. One may alternate, every month, with a saline aperient, and of the many on the market, the author has found Pluto water best. Liquid petrolatum is often used as an intestinal lubricant. Medicines are discontinued as soon as the patient is taught to do without them. A good prescription for atonic constipation attended with flatulence is the following:

R. Fluidext. cascarae sagradae .....	30
Tr. rhei aromatici .....	30
Tr. nucis vomicae .....	20
Elixir taraxaci com., N. F. ....	q. s. ad 120
M. et S.—A half teaspoonful after meals, t.i.d.	

If the patient has hemorrhoids, aloes may be substituted for the cascara.

**The Kidneys.**—It is generally conceded that the kidneys are the most vulnerable point in the body during pregnancy. One surely obtains very valuable information of the general metabolism from the urine, and its frequent examination is a duty of the accoucheur. The woman is directed to send him a four-ounce bottleful

of the morning urine every three weeks until the seventh month; then, every two weeks, and if there is any suspicion of nephritis or toxemia, every day. She is also directed as often to measure the amount passed in twenty-four hours. This must be not less than 50 ounces. Tests are made for albumin, sugar, specific gravity, urea, and for casts. For practical purposes, finer examinations are not necessary. Albumin is significant if found by the usual tests. The author has made these urinalyses for years, and has been rewarded in discovering and forestalling many cases of probable eclampsia and toxemia (see Eclampsia).

**Exercise.**—Violent exercise, of course, is to be avoided. It is not possible to build up a strong muscular system during pregnancy. That should have been done before. To be avoided are jolts, running, sudden motions, lifting great weights, going up and down stairs quickly, horseback riding, cycling, riding over rough roads, golf, tennis, dancing, and swimming. Sea-bathing is adopted by some women to bring on abortion. To be encouraged are walks, up to two miles, in the sunlight, preferably not at night, and carriage drives. Housework is desirable, unless too strenuous.

Railway travel, the automobile, and ocean voyages had better be curtailed, and if travel is necessary, the most comfortable accommodations must be secured. Much depends on the individual, since many gravidæ do the most remarkable things and suffer nothing, while others miscarry from the slightest provocation. The author believes the automobile is responsible for many abortions and forbids touring entirely, and even short rides unless the roads are good. Much depends on the riding qualities of the automobile. If a woman has a known tendency to abort, she must be very careful, and had better even go to bed at the usual time of her menstrual periods. A general massage is often useful, care being taken to avoid the breasts, the abdomen, and varicose veins.

The patient may go to the theater, but must avoid crowds, for fear of getting into a crush. She must avoid gatherings in close rooms, especially with stove heat, because the fetus is very susceptible to coal-gas.

**Coitus During Pregnancy.**—This is a subject on which much has been written, and deservedly, because it is of great importance. Many women have a distaste for intercourse during this time; in others the desire is increased, rarely to nymphomania. There are many reasons for forbidding coitus during gestation:

First, the danger of abortion, which is caused by the impact of the penis against the cervix, and the great congestion of the parts during the act. No doubt the frequency of miscarriage in the newly married is due to this cause.

Second, the nervous shock is not well borne by a woman whose nerve energy is already overtaxed. It aggravates the leukorrhea, and often increases the nausea and vomiting. In some cases the presence of the husband incites an attack of vomiting, and removal of the patient from home may be necessary.

Third, animals do not copulate when the female is pregnant, and, while the habits of other animals do not guide man, in many cases it would be wise for him to follow their instincts.

Fourth, the danger of infection. This is a real danger, the author knowing of two cases where fatal sepsis resulted from coitus just before labor, and several other cases where severe puerperal fever was in all likelihood the result of this pernicious practice. The danger, of course, is greater in multiparæ in whom the cervix is patulous.

Other reasons that have been given are more or less fanciful—for example, that it makes the child sensual, that it weakens it, that the wife will lose respect for her husband. The danger from coitus is greatest in the first three months, when usually the fact of pregnancy is not always sure, and in the last three months, when the abdominal tumor is large and the element of infection more prominent. It is wise to restrict the practice to the intervening months, or, better, advise against it entirely.

Parvin devotes some space to this subject, and refers to the distaste of coitus in the wife as one of the signs of pregnancy mentioned by Susru-fa. African tribes and other savages forbid it, the Chinese and Indians, likewise. The Talmud forbids it conditionally. Swift, in his terrible satire on the human race, in "Gulliver's Travels Among the Houyhnhnms," says that "this is such a degree of infamous brutality as no other sensitive creature arrives at," that is, "that the She-yahoo admits the male while she is pregnant."

The ancient Irans, Medes, and Persians punished the man heavily for such an act; he received 2000 lashes and was compelled to carry 3000 loads of heavy and light wood to the fire, sacrifice 1000 small animals, kill 1000 snakes, 1000 land lizards, 2000 water lizards, and 3000 ants, and build 30 bridges over flowing water (Ploss).

**Bathing.**—Cold and hot baths, Turkish and Russian, hot sitz-baths, and ocean bathing are to be avoided, because of the danger of exciting uterine contractions. Tepid baths, with cool spongings, may be taken freely. They aid the kidneys in the work of excretion and preserve the person from odor. During pregnancy the skin secretes more. Sea-salt baths at home are good, but if the patient feels exhausted afterward, they are to be stopped. A light general massage after the bath is very grateful to the patient. For the profuse sweating which is sometimes an annoying symptom, a bath followed by a brisk rub with a "salt towel" is useful. A "salt towel" is made by wringing a bath-towel out of a strong brine and drying it.

Among the poor there is a notion that bathing during pregnancy is dangerous. Is it possible that old experience discovered some harm in it? We know that the full tub-bath, during or near labor, may cause infection, through the polluted water gaining entrance to the vagina. Therefore the author advises his patients, in the latter weeks of pregnancy and in labor, to employ only the shower.

*Vaginal douches*, unless indicated by disease, are not to be used. Only mild antiseptics may be employed, tepid, and given under low pressure, 12 to 18 inches. One of the best medicaments is potassium permanganate, gr. v ad Oij. Existing gonorrhea must be treated thoroughly, to avoid conjunctivitis in the new-born and puerperal accidents in the mother.

**Mental Occupation.**—Most women have sufficient to do in their household, and the question of an especial obstetric literature does not come up. Occasionally the accoucheur will be asked to recommend a book on the subject of the care of the mother during pregnancy. There are many on the market, some of the best being "Wife and Mother," by Pye Henry Chevasse, and those by Fry and J. M. Slemmons on Maternity. The author questions the wisdom of giving gravidæ books which describe the anatomy and physiology of the function. She should be advised to avoid them.

Some women believe that, by reading fine literature, the child will be intellectual, by studying music, musical, by practising the arts, artistic. Since these enjoyments do no harm, but rather keep the mind away from injurious thoughts, the woman may be humored in the idea, though the physician may express a gentle disbelief in the notion. This brings us to the subject of—

**Maternal Impressions.**—By this term is meant those impressions on the mind or body of the child in utero which result from a similar impression on the mind or body of the mother. The belief that if a pregnant woman should see an ugly or terrifying object it would be reproduced in the offspring dates from remotest antiquity, and is spread all over the world, even in darkest Africa. The Biblical story of Jacob and the "speckled and spotted kine" proves its existence in the civilized, and the practices of the savages in many parts of the world show that the notion existed among the uncivilized, peoples for ages (Ploss). Novelists (Goethe, Scott, Dickens, O. W. Holmes, Shakespeare, Sterne, Hawthorne) have used the idea as a pet theme, and many names great in medicine and allied sciences could be quoted in its support. A few are Van Swieten, Boerhaave, Morgagni, Rokitansky, Burdach, Stoltz, Liebrecht, Delassus, Monteggia, Montgomery, Tyler Smith, Fordyce Barker, Busey, Parvin, Goodell, Penrose, King, Davis, and Edgar. Nevertheless, most of the later writers, particularly the teratologists, call the belief a superstition, absurd and harmful. Blondel (London, 1727) fought against the theory.



walls are weak. If corsets are worn during pregnancy, they add to the strain on the lower abdomen, and thus favor muscular weakness. High-heeled shoes are another factor. Overstraining during labor and inattention to the bowels after labor are also causative. To prevent the muscular insufficiency, one must begin with the girl. She should develop herself as does the boy, with active sports—rowing, swimming, climbing, etc. When a young woman, she should not “lace” and thus paralyze the abdomen. Healthy exercise of the whole body should form part of her daily routine. The abdomen may need some support during the last three months of pregnancy, which may be obtained by one of the maternity corsets recommended. A special abdominal binder may sometimes be needed, especially in multiparæ with already weakened walls or with twins, polyhydramnios, etc. After the birth of the child the nurse should see that the bowels are regularly emptied and that gas does not accumulate in the intestines. The binder, after labor, does not prevent “high stomach,” and while the writer recommends it (see Treatment of the Puerperium), the most benefit obtained from it is when the patient first leaves the bed. To bring the abdominal walls back to their original tonus the nurse may, after the uterus has sunk into the pelvis, give them a daily five-minute massage.

To prevent the overstretching of the skin and the formation of the *lineæ* or *striæ gravidarum*, our efforts are not very successful, but the writer recommends skin massage with albolene or fat. Several such remedies are much vaunted in newspaper advertisements.

Women whose legs become swollen and full of immense varicose veins should wear rubber stockings. Varicosities, when large and extensive, are a congenital defect and unpreventable.

**General Instructions.**—In general, the obstetric case is to be treated as a major surgical case. The woman is requested to report any symptom that annoys her, especially headache, edema of the extremities, bleeding from any part of the body, constipation, diminished urine, nausea and vomiting. It is wise for the physician to see her frequently during pregnancy and judge for himself if her condition is satisfactory.

The blood-pressure is to be taken regularly every three weeks until the seventh month and every two weeks thereafter. The urine should be examined with the same frequency, but midway between the blood-pressure readings, and thus the physician will have knowledge of the condition of the patient every week or ten days.

Women complain that their accoucheurs do not take enough interest in them—a charge which is true. Instructions are to be given regarding the advent of labor, how the patient may decide that it is at hand, and cordial encouragement should be offered her, since she awaits the event with much anxiety and trepidation. Do not neglect the mental state of the gravida.

### THE PREPARATION FOR THE ASEPTIC CONDUCT OF LABOR

Unless the woman is to go to a maternity for delivery, the same preparations must be made at home as for a major surgical operation at home. Thousands of mothers and children die every year because of the lack of such preparation, and of the spirit that animates it. The principles of asepsis and antisepsis are not complicated nor hard to apply. They are only two: everything that is to come in contact with the puerperal wounds must be absolutely sterile; second, the external genitalia and introitus vaginae must be thoroughly disinfected. If these two principles are deeply ingrained in the accoucheur's mind, the methods of carrying them out will suggest themselves. The ponderous and complicated system of asepsis practised in hospitals is not possible nor necessary in the home; but, on the other hand, the ideals of asepsis are not met by a basin of bichlorid solution and a roll of absorbent cotton.

A list of the utensils (a copy of the author's being reproduced herewith)—

dressings, cottons, brushes, etc.—needful for confinement is to be supplied each patient, with instructions how to prepare same, so that, when the time comes, everything is in readiness for an aseptic and correct accouchement. The nurse engaged for the case, three weeks before the day set for labor, goes to the patient's home and sterilizes a supply of towels, sheets, cotton sponges, gauze, umbilical pads, vulvar pads, and binders. The woman herself may be instructed in these matters. In the cities there are nurses who make a specialty of such preparations. Maternity outfits containing all the needed utensils, gauzes, dressings, pads, sheets, towels, etc., already sterilized, and neatly packed in sealed containers, are sold by surgical supply houses. Among the poorer classes the physician may have to carry everything necessary for an aseptic labor with him.

#### LIST OF ARTICLES NEEDED FOR LABOR

3 basins (enameled).  
 1 pitcher (enameled), 4 quarts.  
 1 pitcher (enameled), 1 quart.  
 1 Perfection bed-pan.  
 1 fountain syringe (new), 2 quarts.  
 1 hot-water bag.  
 2 pieces rubber sheeting, 1 piece large enough to protect mattress, 1 piece 1 yard square.  
 1 medicine-dropper.  
 1 medicine glass.  
 2 bent glass drinking tubes.  
 8 ounces lysol.  
 1 bottle bichlorid of mercury tablets.  
 8 ounces tincture of green soap.  
 2 ounces castor oil.  
 1 tube white vaselin.  
 8 ounces alcohol.  
 1 ounce fluidextract of ergot.  
 4 ounces benzoinated lard or albolene.  
 1 rubber catheter, No. 14 French scale.

The following are used for making pads, sponges, applicators, etc.:  
 6 pounds absorbent cotton.  
 1 bolt of gauze.  
 10 yards unbleached muslin.  
 100 vulva pads.  
 1 accouchement pad, 1 yard square.  
 200 applicators.  
 18 cord dressings.  
 1 skein linen bobbin,  $\frac{1}{4}$  inch.  
 1 pair white stockings, long.  
 4 breast binders.  
 3 night gowns (short).  
 4 quilted pads, 2 feet square.  
 4 sheets.  
 18 towels (without fringe).  
 4 Mason jars, 4 jelly glasses (with covers).  
 Bundle of newspapers.  
 All the soft white rags the patient can gather.  
 Receiver for baby.

The basins, brushes, and douche-bag are carefully sterilized in dust-proof bags. One pound of the cotton is made into pledgets or sponges of convenient size, packed into glass jars, and sterilized. The other pound is made into large vulvar pads, covered with gauze. These are sterilized in packages of six. The newspapers are sterilized by steam with the pledgets and pads, or by baking in the oven, and serve many purposes—for example, to wrap up basins, towels, sheets, Mason jars, etc., that have been sterilized before labor, to place under the patient during labor, and to lay on tables and chairs to avoid marring them. A sterile newspaper wrapped in a sterile towel makes a good bed-pad during delivery. After everything has been sterilized, the packages are labeled and put away in a clean drawer or trunk. At the time of labor the accoucheur finds things all prepared and ready, a most comforting feeling. Well prepared is half the battle.

#### RULES FOR PREGNANT WOMEN

(This set of rules is printed on the reverse side of the slip giving the list of articles needed for labor.)

1. Consult your physician as soon as you believe pregnancy probable.
2. Dress warmly. Avoid circular constriction at any part of the body. As soon as the child's motion is felt lay off corsets; wear a maternity waist with breast supporter.
3. Take plenty of mild exercise in the open air and sunlight, especially walking, stopping short of fatigue. Avoid violent motions, golf, tennis, swimming, long trolley or automobile rides, etc. Traveling is permitted only when really necessary.
4. Take no hot nor cold baths, only tepid, with cool sponging. In the last three weeks before delivery, no tub baths; use the shower and sponging. Take no douches, unless ordered, and, especially in the last month, allow nothing to touch the internal genitalia.
5. Intercourse should be avoided if possible, always restricted, and absolutely forbidden during the last six weeks.
6. The bowels must move every day.
7. Eat your usual amount of food, restricting the meats or their equivalent, fish and eggs, to 4 ounces a day. Drink freely of water, milk, or buttermilk. No alcoholics. {During the last six weeks reduce the diet generally, and especially the sweets and fats.
8. Keep the breasts free from pressure. Bathe the nipples once a week with tincture of green soap, and anoint them daily with sterilized albolene.

9. Send a 4-ounce specimen of the morning urine for examination every three weeks; after the seventh month, every two weeks. Once every week measure the amount of urine passed in twenty-four hours. It should be 3 pints.

10. The blood-pressure should be taken every three weeks up to the seventh month, and every two weeks thereafter. Send the urine one week and appear for the blood-pressure reading the following week.

11. Report to your physician when you are troubled with nausea, vomiting, headache, swelling of the feet or eyelids, or other abnormal symptoms. Report also any marked reduction in the amount of urine and if there is hemorrhage from any part of the body.

12. If you are in need of advice during my absence, summon my Assistant,  
Dr. .... Telephone. ....  
who will, if necessary, call my Associate, Dr. ....  
Telephone. ...., or Dr. ....  
Telephone. ....

13. At the first consultation a careful examination must be made, and near term, another.

14. When labor-pains begin, or if the waters break, or if the show of blood-stained mucus appears, go to the Chicago Lying in Hospital, call your nurse, and notify the accoucheur.

15. Six to eight weeks after delivery the patient should come to the office for final examination, to determine if the womb is in place and if there has been any excessive injury to the parts.

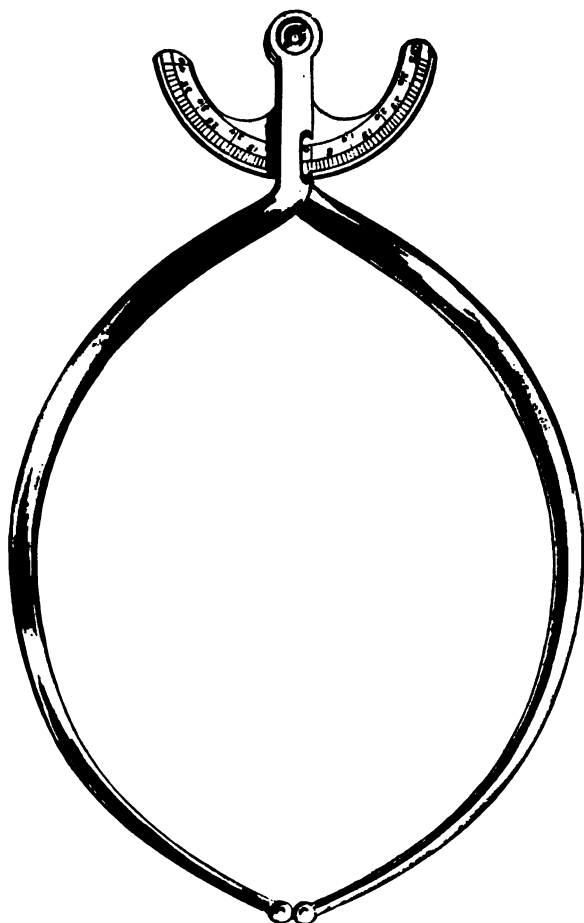


FIG. 260.—BAUDELLOCQUE-BREISKY PELVIMETER.  
Very slightly modified by the author.

**The Physician's Examinations.**—It is wise for the accoucheur to make a complete general and pelvic examination of every woman when she engages him to take care of her during confinement. In the general examination especial attention is to be given the heart and lungs. He may discover a contracted pelvis, an extra-uterine pregnancy, an ovarian tumor, or other condition which may be removed at this time safely for the patient, while if left for chance discovery, the favorable period may have passed by. Further, he must make sure that the woman is pregnant to spare himself mortifying surprises. The woman will not object to the examination if its necessity is explained. A card or history sheet should be filled out at this first visit, which should contain a complete medical history of the patient. This may bear on the obstetric side of the case. The card used by the author is reproduced on p. 252, Fig. 279. The urinalyses, the results of examinations, systolic and diastolic blood-pressure, and items of interest during the course of pregnancy, are recorded

on the card. Every week, at a time set apart for the purpose, the physician looks over these cards and gets in touch with the individual patients. If, for example, the record shows that no urinalysis has been made for a long time, the patient should be reminded of such a necessity.

When the call to a labor comes, the card should be taken to the case. The

ng practitioner is advised to use the history sheet, reproduced in the Appendix, in the early years of his practice. It has not the advantage of convenience of the card, but it is more detailed and more complete. It will develop habits of thoroughness and broaden his mind. In later years he will be too busy to fill out detailed records, then the card will afford him sufficient space for the important necessary entries. The keeping of accurate and complete records is a duty which the physician owes his patient, his profession, and himself.

Some time during the eighth month the patient should be thoroughly examined. This examination is best made in a maternity on the delivery bed, with the patient undressed. It can be conducted at the patient's home or even at the physician's office, though not as thoroughly. While the greatest attention is paid to the pelvis, the heart and lungs should be studied, with a view to discover any defects which might jeopardize the pregnancy or the patient in labor. The size and consistency of the breasts and the configuration of the nipples are studied with a view to determining the woman's ability and fitness for lactation. Far from objecting,

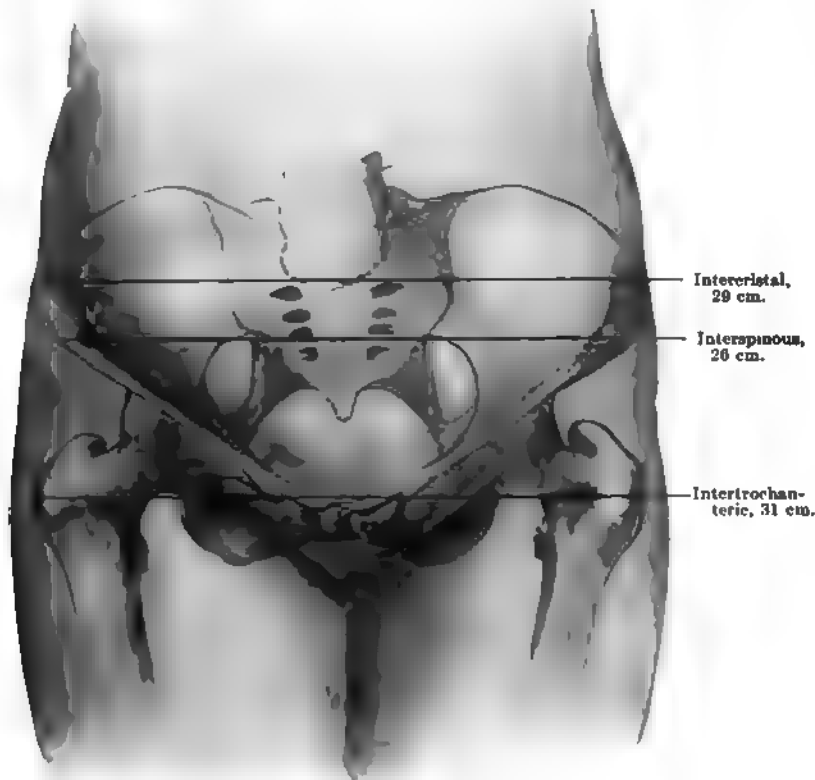


FIG. 261.—THE EXTERNAL MEASUREMENTS. SHOWING WHERE TO PLACE PELVIMETER.

patient will approve of such care and thoroughness in the study of her case, and will give her increased confidence in her accoucheur. After the chest, including the breasts, has been examined and the information noted on the history sheet or card, the patient is arranged lengthwise on the bed or table, the abdomen bared, the chest and extremities being appropriately draped with sheets, and all the information that may be gained by abdominal examination is sought and recorded. The physician notes the size, shape, and consistence of the uterus, the position and size of the ovaries, its heart-tones, and the presence of abdominal tumors beside the uterus. The external pelvic measurements are now taken, using a pelvimeter (Fig. 260). The following are the most useful:

1. The distance between the spines of the ilia, always taking the outer lip. The *distantia spinarum iliorum*, or *Sp. I.* = 26 cm.
2. The distance between the crests of the ilia, taking the outer lip, the *distantia cristarum iliorum*, or *Cr. I.* = 29 cm.
3. Between the great trochanters, *distantia bitrochanterica*, or *Bi. T.* = 31 cm.
4. From the depression under the last lumbar spine to the anterior surface of the pubis—*conjugata externa*, diameter Baudelocqui, or *D. B.* = 20 cm.
5. The circumference of the pelvis, 90 cm.
6. The obliques, from the right posterior superior spine of the ilium to the left anterior superior, *obliqua dextra*, *Ob. D.* = 22 cm.; and the corresponding oblique of the other side. *Ob. L.* = 21½ cm.



FIG. 262.—TAKING INTERSPINOUS DIAMETER.



FIG. 263.—TAKING BAUDELLOCQUE'S DIAMETER.

The author takes the obliques only in cases where there is scoliosis and other evidence of pelvic asymmetry. Fig. 262 illustrates the manner of taking the external diameters. Baudelocque's diameter is best obtained when the patient is erect, as in Fig. 263, but one can get it with the patient lying on the side, with the upper leg straight, the lower drawn well up against the belly. The posterior branch of the pelvimeter is placed in the dimple under the last lumbar spine. This point is one inch above a line drawn between the two posterior superior spines. On the

rior aspect of the pelvis, in well-formed women, is a diamond-shaped depression bounded by the dimples of the posterior superior spines of the ilia, the lines formed by the gluteal muscles and the groove at the end of the spine. It is called the rhomboid of Michaelis, and is seen on beautiful statues—for example, the Capitonus (Fig. 264). The point for the calipers is near the apex of the rhomboid. Variations in the shape and size of this landmark give us valuable information in constricted pelvises. Anteriorly, the knob of the pelvimeter comes to rest on the prominent portion of the bony pubis. It is wise to take Baudelocque's measurement three times and use the average of the three measurements.



FIG. 264.—THE RHOMBOID OF MICHAELIS.



FIG. 265.—DELEE'S INTERNAL PELVIMETER.

The circumference is taken with the tape lying between the crests of the iliac trochanters on each side, and in a plane perpendicular to the long axis of the body. Naturally, in fat women the circumference does not give valuable information. Indeed, the value of the external measurements is but relative. Only marked deviations from the normal indicate a contraction of the pelvis, and one must rely on the internal examination for more positive information.

Baudelocque believed that, by deducting 8 cm. from the external conjugate, the length of the vera could be obtained. This is not true, because the thickness of the soft parts and their conformation, produce differences of even  $5\frac{1}{2}$  cm. (Skutsch and

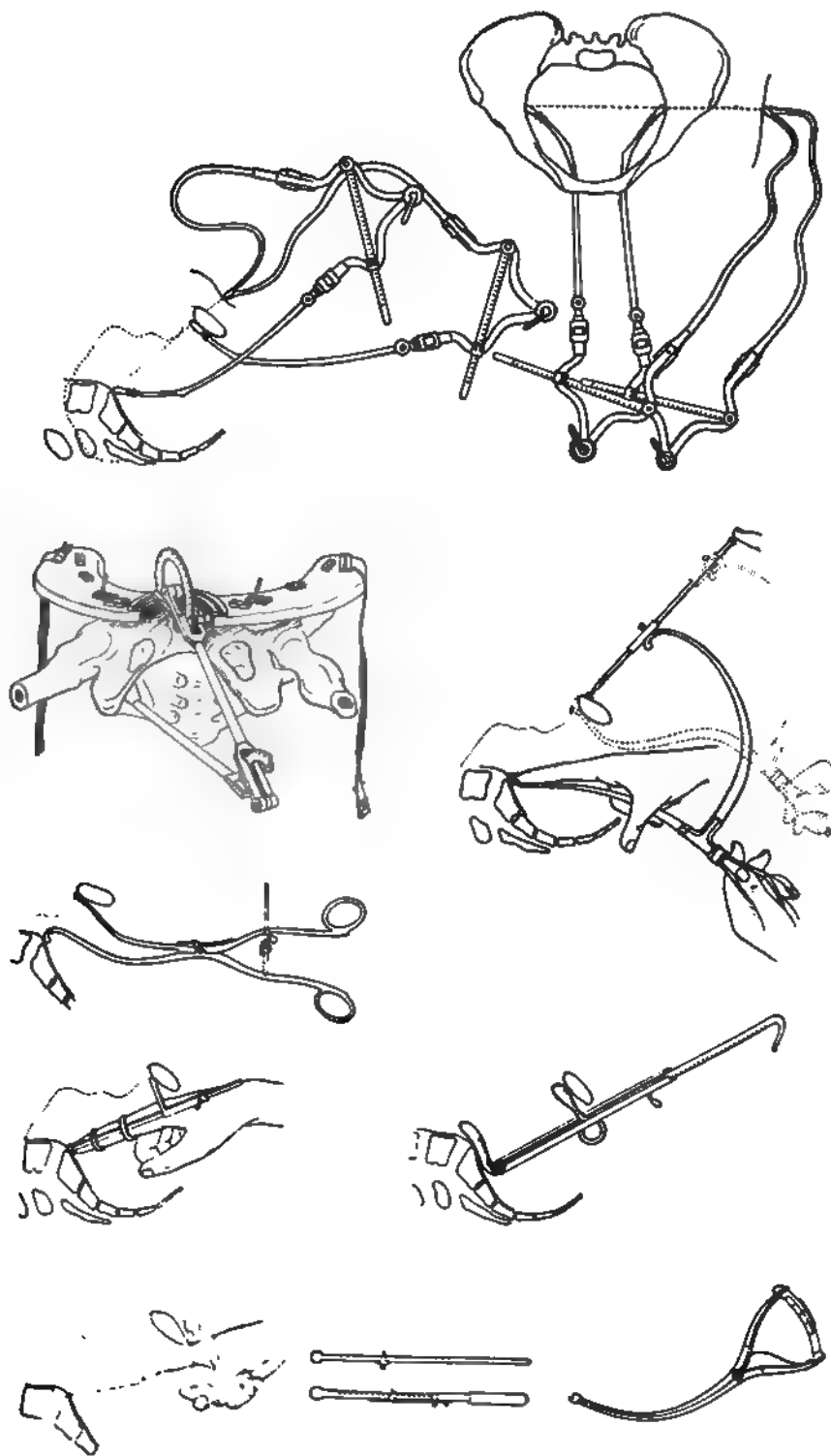


FIG. 206—A FEW OF THE MANY INTERNAL PELVIMETERS.  
Copied from Skutech.

oenner). The author possesses a pelvis with an external conjugate of 18 cm. and C.V. of 14 cm., and another with an external conjugate of 21 cm. and a C.V.  $9\frac{1}{2}$  cm. If a woman has a conjugata externa of less than 18 cm., the probabilities are strong that the inlet is also narrowed.

For the same reason the other measurements are unreliable. The author has a pelvis with an intercristous diameter of 21 cm. and an internal transverse of  $13\frac{1}{2}$  cm. The relation between the interspinous and intercristous diameters is of more importance, for when the interspinous diameter is equal to, or greater than, the intercristous, we suspect a flat pelvis. (See Chapter LIV.) The author insists on internal pelvimetry in all cases, excepting only those women who have had one or more large children without the slightest difficulty.

The internal measurements are taken with the hand and a special internal pelvimeter (Fig. 265). These are essential:

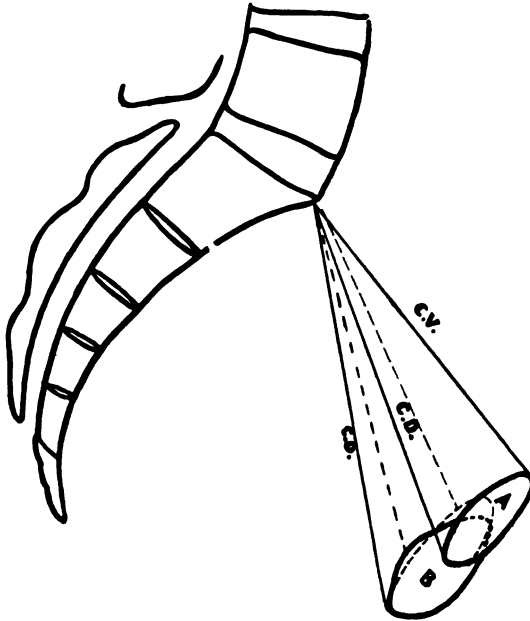


FIG. 267.—DIAGRAM TO SHOW THE EFFECT OF A HIGH PUBIS ON THE LENGTH OF THE C.D. Dotted line shows shortening due to a thick pubis or exostosis. Red line shows effect of long pubic symphysis.

1. The conjugata diagonalis, C.D. =  $12\frac{1}{2}$  cm.
2. The distance between the spines of the ischia, bispinous, Bi-sp. = 11.
3. The distance between the tuberosities of the ischia, Bi-isch. = 11 cm.
4. The distance from the end of the sacrum to the ligamentum arcuatum ubis; sacropubic, S.P. =  $11\frac{1}{2}$  cm.

Of the scores of instrumental methods of measuring the conjugata vera directly, since the first by the elder Stein (1772) up to the latest by Biličky (1909), not one has proved practical (Fig. 266). Their application is too painful and difficult. We still obtain our best information by measuring the conjugata diagonalis and deducing from it the length of the C.V. Even though we can measure the height of the pubis, and thus know the length of two sides of the triangle, it is impossible to learn the arc of any of the angles of the triangle subtended by the symphysis. Trigonometry, therefore, cannot help here—we must depend on estimates. Examination of large numbers of pelves shows that one deducts  $1\frac{1}{2}$  cm. from the length of the C.D., one obtains the length of the C.V. If the pubis is very high, 6 cm. or more (Fig. 267), one must deduct 2 or  $2\frac{1}{2}$



cm. If the upper border of the pubis inclines more than usual toward the sacrum or is very thick, or if there is an exostosis of the posterior surface of the symphysis, both of which last occur in rachitic pelvises, 2 or even 3 cm. may have to be deducted from the length of the C.D. (Fig. 268).

The transverse diameter of the pelvis decreases from above downward. At the level of the inlet it measures 12 to 13 cm.; in the region of the spines, 11 cm.; anterior to the spines, 11½ to 12 cm.; at the outlet, between the tuberosities, 11 cm. In practice, it is only exceptionally possible to measure the transverse of the inlet directly. When labor has been in progress for a time, the vagina becomes so soft and distensible that one can spread the branches of the internal pelvimeter, pictured in Fig. 265, until they touch both sides of the pelvis, enabling one to read off the measurement on the scale with mathematical accuracy. Late in pregnancy it is easy with this instrument to measure the distance between the spines of the ischia. The distance between the tuberosities is not so easily gotten, because of the thick padding of fat over these bones. One must add 1 to 2 cm. to the measure-

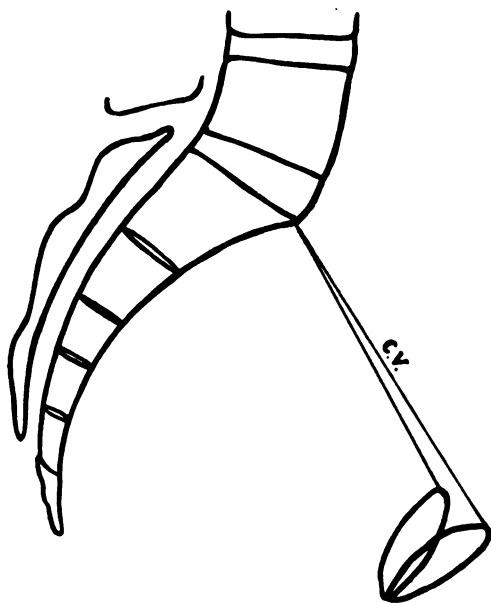


FIG. 268.—DIAGRAM SHOWING EFFECT OF INCREASED INCLINATION OF PUBIS ON LENGTH OF C.V.

ment obtained with the pelvimeter. While the external measurements give only equivocal information, considerable dependence may be placed on internal mensuration, and this will increase with added experience.

*Technic of the Internal Examination.*—During the early part of the eighth month is the most favorable time for pelvic mensuration in general practice. During labor one may have the advantage of anesthesia. The patient must lie across the bed or on a table, with the hips hanging well over the edge, to enable the examiner to sink his elbow. Her person must be draped with a sheet, but the genitalia are to be exposed. For examination, at this period, the genitals need not be shaved, but should be washed with water and soap, following this with a liberal use of antiseptic solution, 1 : 1500 bichlorid or 1 per cent. lysol. Rubber gloves are worn by the author as a precaution against syphilitic infection, for the sake of personal safety, to preserve the skin from the corrosive action of antiseptics, and to make the examination less painful to the patient. The internal pelvimeter is sterilized by boiling in a 1 per cent. soda or borax solution. On inspecting the vulva, to detect any suspicious discharge, abscess, varicose veins, the extent of previous

erations, etc., after which two fingers are inserted between the widely separated labia, deeply into the vagina. It is well to study, in each case, the topography of the levator ani, which can be easily done by pressing the fingers down on either side of the vagina. In a primipara the muscle is broad, sling-like, and on contraction powerfully crowds the fingers against the pubic arch. In a multipara the introitus open, the levator ani is represented by two thick pillars at the sides of the vagina, which, upon contracting, do not crowd the fingers so tightly against the pubis. The condition of the vagina is noted. If there is a granular condition of the mucous membrane which might suggest gonorrhea, a smear should be taken with a view of



FIG. 269.—TAKING DISTANCE BETWEEN SPINES.

preventing ophthalmia neonatorum and sepsis postpartum. Next, the cervix is studied to learn whether it is long, tapir-nose-like, or short and broad; whether patulous, as in multiparæ, or closed; whether normal, smooth, and soft, or diseased, thick, knobby (ovula Nabothi), catarrhally inflamed, or eroded. Then the lower part of the uterus is palpated and the presence of the head determined, at the same time discovering any tumor which may block its entrance into the pelvis. The fingers now pass around the bony walls of the pelvis to obtain a mind picture of the capacity and configuration of the excavation. It requires years of practice for an accoucheur to be able to form correct mind pictures of these things, but they

must be learned. The height of the pubis, its inclination into the inlet, the presence of an exostosis on its posterior surface, the curve of the rami pubis, the height of the

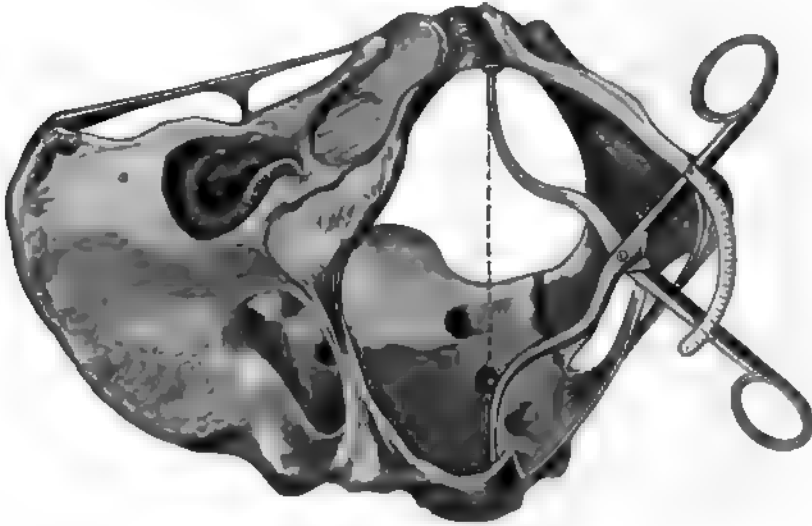


FIG. 270.—DIRECT MEASUREMENT OF ANTEROPOSTERIOR DIAMETER OF OUTLET.  
Possible only at term. Anæsthetic usually necessary.

sacrum, the shape of the sacrum, the movability and shape of the coccyx are determined in the order mentioned. Next the bispinous diameter is taken with the



FIG. 271.—TAKING THE CONJUGATA DIAGONALIS.

pelvimeter. The instrument is closed and passed, with the scale upward, along the finger until it has passed the grip of the levator ani, then the blades are spread

one knob comes to rest on, or just in front of, the spine of the ischium (Fig.

Being assured that the patient's hips are horizontal, the blades are spread in horizontal plane until they are arrested by the bony walls of the pelvis, and at instant the amount of separation is read off the scale. This measurement cause little pain if the vagina is soft and dilatable (which is usual at this time), the examiner proceeds slowly and gently. If the vagina is diseased, it is more

Under no circumstances may force be used, as a tear of the vagina might

If the blades easily spread to 10 cm. and there seems to be room beyond, not necessary to insist on the full measurement. In a contracted pelvis it is to obtain the distance. To take the sacropubic diameter from the inside always possible without anesthesia, and less often in primiparæ in whom the os pubis rises high. Fig. 270 shows how it is done. One knob is steadied by the other hand against the ligamentum arcuatum at the side of the clitoris, while the other knob is pressed against the end of the sacrum, being guided into place by the fingers in the vagina. One may measure the sacropubic diameter with the pelvimeter in the same manner as one measures the diagonal conjugate. Now the instrument is removed and the examiner takes the conjugata diagonalis (Fig. 271).

Placing the elbow and resting it on the knee, the examiner gently, with force, presses the middle finger against the promontory of the sacrum. It may be necessary to keep steady pressure against the perineum for several minutes before the muscles will relax. As soon as the tip of the promontory is felt, the finger is raised against the ligamentum arcuatum. A bit of cotton carried by the index of the other hand is pushed along the index of the examining hand until it rests at the point where the examining hand is held by the ligamentum arcuatum.

After making sure that the finger-tip was actually resting on the promontory at the time the cotton reached the under edge of the pubis, the cotton is carefully held in its place by the outside

while the internal hand is removed from the vagina. With a tape-measure pelvimeter one now obtains the length of the conjugata diagonalis (Fig. 272). Judging at the inclination of the pubis and allowing for its height, one deducts 2 or more cm., and thus approximates the length of the C. V.

Several methods may be practised in obtaining the bituberal or biischiatric diameter. Schröder made marks on the skin of the buttocks to show the location of the inner surface of the tuberosities and measured the separation of the marks. One may measure the distance between the two thumbs so placed on the buttocks that the finger-nails represent their inner surfaces. Two, three, four, or five fingers of the hand may be pressed in between the bones, and the distance across the fingers measured with a tape. Williams' pelvimeter may be used or the internal pelvimeter shown above. The closed knobs are inserted between the bones and



FIG. 272.—MEASURING LENGTH OF C.D. WITH AUTHOR'S PELVIMETER.

separated until they are arrested (Fig. 273). It is necessary to press the tissues well against the bone and to add 1 to  $1\frac{1}{2}$  cm. to the reading for the thickness of the fat.

The sacropubic diameter may also be taken from the outside by Breisky's method (Fig. 274). One knob of the pelvimeter rests under the arch of the pubis, the other is pressed against the sacrococcygeal joint, 1 cm. being deducted from the reading to obtain the result.

Finally, the examiner carefully palpates the accessible bony portions of the pelvis. The fingers of each hand are laid on the descending rami of the pubis and the acuteness of the angle of the arch thus easily determined (Fig. 275). Thickness



FIG. 274.—TAKING DISTANCE BETWEEN TUBEROSITIES.

of the bones, asymmetry of the two sides, a beak-shaped pubis (osteomalacia, rickets, see Chapter LIV), are thus discovered (Fig. 276). As the last maneuver, the hand is laid flat on the sacrum, the middle finger pressed firmly into the genital crease, to conform to the curve of the bone. On removing the fixed hand, the external configuration of the sacrum can be seen at a glance (Figs. 277 and 278).

A study of the general makeup of the gravida will tell us a great deal. Tall, muscular women seldom have contracted pelves, and, if they do, the type is usually scoliotic. Short, petite women may have generally contracted pelves. A woman with limps, or is hunchbacked, or has crooked legs, may have a distorted pelvis. Deformities of rickets should always be sought in the rachitic rosary, the square, or wedge-shaped head, enlargement of the epiphyses, bow-legs, curvature of the spine, etc.

Much more could be written on pelvic mensuration, but little that is practical. Röntgenography (Budin) has failed to give accurate results, as far as mensuration is concerned, but it does give some idea of the shape of the pelvic cavity, especially the recent stereoscopic methods. (Chapter LIV.) Cliseometry is a method, devised by Neuman and Ehrenfest, for taking the measurement of the pelvis. The cliseometer invented by them gives fairly satisfactory readings, but the information is of little practical value. They also devised an instrument built on the lines of the ordinary pantograph, with a spirit-level for obtaining accurate outlines of the entire pelvic cavity. While the results are usable, the application of the instrument is quite painful and complicated, precluding its employment as a routine.



FIG. 274.—MEASURING SACRO-PUBIC DIAMETER. BREISKY'S METHOD.  
Photograph, Chicago Lying-in Hospital.

All this information is to be carefully entered on the history sheet or card (Fig. 275). If the physician conducts his examination systematically, he will not overlook any points and have the disagreeable necessity of putting the patient back on the table. In discovering anything unusual in the pelvis, soft parts, or child, the examination takes on extra interest, and special attention will have to be directed to the part. A discussion of these special subjects will be found under the appropriate headings. A careful consideration of all the information obtained enables the accoucheur to make his diagnosis of the case, the prognosis of the labor, and any recommendation of treatment at this time, all of which are noted on the card. Too much emphasis should not be laid on the importance of making a careful pelvic mensuration in pregnancy. It may discover a contracted pelvis and permit us to induce labor while the child is small, or prepare for cesarean section or other operative delivery at term. It will explain many anomalies in the mechanism of labor, and it will save many mothers' and children's lives.

**Visit Before Labor.**—It is not wise to allow the gravida to go into labor with an abnormal presentation. Shortly before the date set for confinement (see p. 26 for the determination of this date), the accoucheur should call on the woman, inquire into her general condition, and make both an abdominal and rectal examination to determine the position and presentation of the child and the degree of

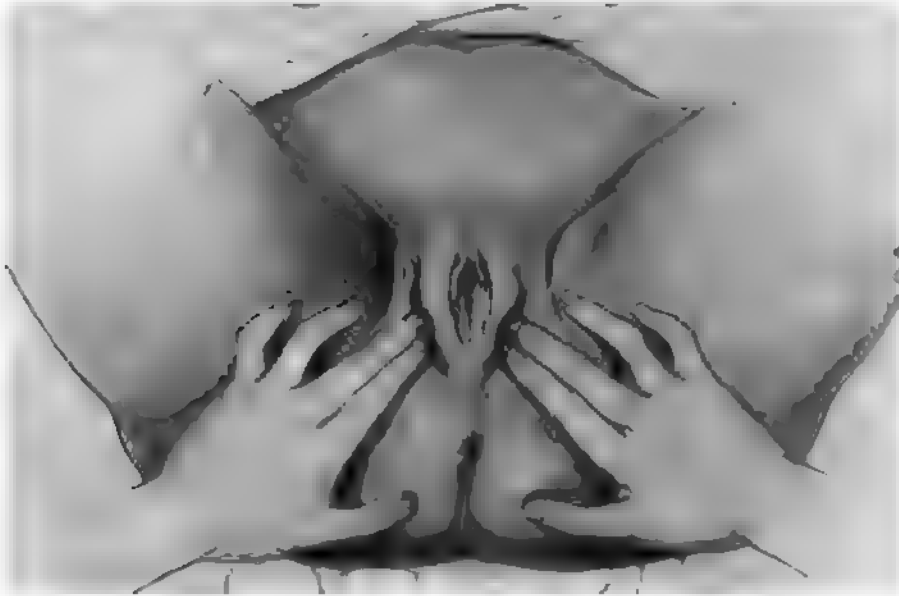


FIG. 275.—PALPATING PUBIC ARCH.

engagement. To avoid repetition, the methods of diagnosis of presentation and position will be considered in full in the conduct of labor. After this point is settled the heart of the infant should be auscultated. It is possible to diagnose fetal heart disease before delivery. A question usually put to the accoucheur is one regarding the sex of the child. This cannot be told before delivery. Frank-

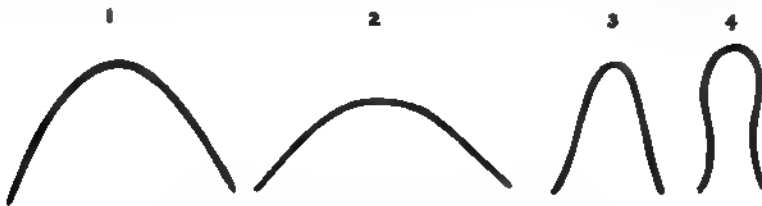


FIG. 276.—VARIOUSLY SHAPED ARCHES OBTAINED IN PRACTICE.

1, Normal. 2, Broad—as in flat pelvis. 3, Narrow—as in male pelvis. 4, Osteomalacic beaked pelvis.

häuser claimed that the girl's heart was more rapid than the boy's, so that if the fetal heart-tones were persistently below 135 per minute, a male child could be predicted. The author has paid special attention to this point, and has found that, as a rule, the girl's heart beats a little faster than the boy's, but that much depends on the size of the infant—the larger the child, the slower the heart. If the child's heart beats persistently above 140 per minute, one will be correct

the prediction of a girl three out of five times; if below 135 persistently, one expect a boy with the same slight degree of confidence. The patient is ad-



FIG. 277.—OUTLINING THE SACRUM.

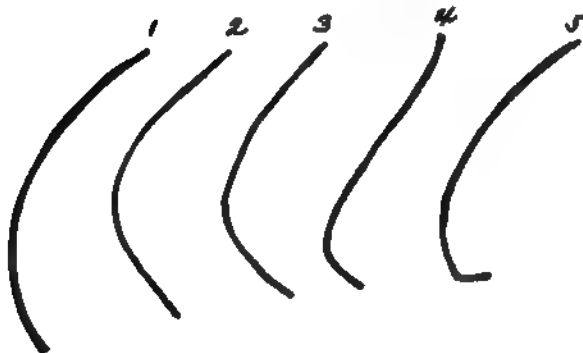


FIG. 278.—SACRAL OUTLINES.

1, Normal curve. 2, Rachitis. 3, Rachitis. 4, Rachitis. 5, Ankylosis of coccyx.

l, however, that the doctor is only guessing. There are no other means of guessing the sex before labor. Serology has failed.



At this visit, unless previously instructed, the woman is told how to decide that labor has begun, and when to call the accoucheur and nurse, and what physician to summon in the event of an emergency, when the regular attendant is not obtainable. She is advised not to take tub-baths, to keep the bowels very free, to limit the meat in her diet, and to drink a great deal of water.

**The Engagement of the Nurse.**—An accoucheur's success in obstetrics depends largely on the nurse. A careless nurse can undo his best work. After the diagnosis of the time of labor is made, the nurse is engaged and holds herself in readiness for call at that time. The physician should select the nurse, the woman's preferences in the matter being consulted only when they agree with his. A good nurse possesses these qualifications: She should be neat, clean, strong, healthy, and in love with her work; she should be a graduate of a training-school where she has had special obstetric training, and she should be well acquainted with the methods of her physician; she should be sympathetic and agreeable to the patient, and faithful to the accoucheur; she should not be a tale-bearer, should not quarrel with the servants in the house, but should be tactful in all her actions. Such nurses are in great demand, and it is well for each obstetrician to have several, specially trained for his own needs, at his service. Unless the accoucheur has a staff of such nurses, it is advisable for him, if he wishes to avoid mistakes and meddlesome, though well-intentioned interference on their part, to provide a list of printed instructions regarding the care of the mother and babe during labor and puerperium. The author refers his nurses to a book written by him, "Obstetrics for Nurses," and thus avoids a great deal of detailed explanation.

#### INSTRUCTIONS FOR THE OBSTETRIC NURSE

Two to three weeks before the date of expected labor, visit the patient and prepare the materials needed for confinement. See that everything on the list of articles needed (p. 237) is at hand.

Basins, bed-pan, brushes, douche-bag, and all utensils are carefully sterilized by steam; the Kelly pad, by soap and water and soaking in 1:1000 bichlorid for three hours; the douche-bag is to be boiled.

Prepare one dozen towels, three sheets, two pairs very long stockings, or special leggings, two pillow-cases, two night-gowns, two physician's gowns, two quart Mason jars of gauze sponges, two quart Mason jars of cotton sponges, two pads of cotton covered with gauze, one yard square, a receiver, and sufficient vulvar pads and umbilical cord dressings for the mother and babe during the puerperium. These are all packed in appropriately sized bundles, securely covered with towels or newspapers, distinctly labeled, then sterilized. All these things are carefully laid away, protected from dust, for the time of labor.

Instruct the patient how to determine when labor is at hand, and what to do until you or the doctor arrives.

**DURING LABOR.**—When you are called, see that the accoucheur is at once notified.

See that there is a supply of hot and cold sterile water.

Prepare the patient as follows: Give colonic flushing of warm soapsuds; shave genitalia; give a shower-bath; scrub torso with soap and water, paying special attention to the genitalia; rinse and wash thoroughly from ensiform to knees with 1:1500 bichlorid. Put on sterile night-gown.

Do not examine the patient internally nor give vaginal douches without permission.

Keep an accurate record of pulse, temperature, and all the occurrences during labor and the puerperium. Listen to fetal heart tones frequently and note.

See that the patient takes light nourishment during the first stage.

Provide quiet, cheer, and fresh air for the patient. Allow no gossip.

See that the bladder is emptied every four and the rectum every twelve hours, asking the accoucheur for orders regarding them.

When the second stage draws near, dress the bed and the patient with the sterile articles.

Be ready to assist the accoucheur in caring for the feces which may escape from the anus (use of 1:1500 bichlorid and large cotton sponges).

Have sterile scissors, tape, and artery clamp ready for the cord, and gauze pledgets for wiping the eyelids and throat. Antiseptic for the eyes. Sterile catheter.

As soon as the child is severed, wrap it warmly in the receiver and put in a warm, safe place. Look at it occasionally for hemorrhage from the cord or choking.

Receive the placenta in a basin covered with a sterile towel, and be sure to present it to the accoucheur for his inspection.

**DURING THE PUERPERIUM.**—Treat the genitalia as an open surgical wound. Change the dressings when soiled, douching the external genitals with 1:3000 bichlorid each time. Give no vaginal douches without orders. See that the patient urinates within eight hours after delivery.

Give her one ounce of castor oil on the morning of the second day after delivery. Get further instructions from the accoucheur.

Support the breasts and abdomen with light binders.

Report to the accoucheur sleeplessness, temperature above 99.5° F., pulse over 100, headache, hemorrhage, severe after-pains, abdominal distention or pain, dysuria, fetid or abnormal lochia, infected perineum, cracked nipples, engorged breasts, and anything unusual.

The diet is to be liquid for twelve hours, then light.

Take temperature, pulse, and respiration at 7 A. M., 4 and 9 P. M.

Consult the accoucheur regarding the time to get patient out of bed.

CARE OF CHILD.—See that the eyes are cared for according to the accoucheur's practice.

Anoint the child with albolene, rub all off, then disinfect with alcohol and dress the cord with dry sterile gauze. Change only when soiled.

Wash eyelids and nostrils once daily with extreme gentleness. A half-bath daily until navel is cicatrized, then a full bath or an oil rub.

Take temperature and pulse A. M. and P. M. Weigh daily. Record everything.

Give 10 drops of castor oil on morning of second day.

Let infant nurse every four hours until milk comes, then every three, beginning at 7 A. M.

Let nurse once after 10 P. M. until one week old, then train to sleep the night through.

Report to the accoucheur temperature above 99.5° F., absence of bowel movements or urine, convulsions or nervous symptoms, vomiting, redness of eyes or navel, hemorrhage from any place.

In general, the breasts, the genitalia, and the navel of the infant must be regarded as open wounds and treated invariably with extreme surgical cleanliness.

### ANTENATAL THERAPEUTICS—PRENATAL CARE

Closely allied to the subject of eugenics is the special care of the woman and her babe during pregnancy, with a view of producing healthy and mature offspring. All that has been previously said in this chapter really has this object; but if one bends his mind to the matter, one will agree with Ballantyne that there exists here a field still sparsely settled, very vast, and intensely alluring. We seek to discover and counteract the effects on the fetus of syphilis, tuberculosis, hemophilia, alcoholism, and other chemical poisons, lead, arsenic, phosphorus, tobacco, etc. We seek to discern the causes of abortion and premature labor and to avoid them; also to learn to cure those diseases which necessitate the artificial interruption of pregnancy—for example, hyperemesis gravidarum, chorea, placenta prævia, etc. We seek to trace the occurrence of fetal monstrosities, but have not advanced at all in this direction, even in the cases of those women who have such a hereditary disposition. (See Williams.)

In practice among the well-to-do the children are larger and stronger than among the very poor, though the difference is not as great as one would expect. Studies of the factory workers in Europe, where the proportion of the operatives that are pregnant women is larger than with us, have proved that their children are more likely to be premature, puny, undersized, or weakly. Certain cities have arranged to give the pregnant woman a respite from work for six weeks before delivery and four weeks afterward, and France, Italy, and Switzerland are considering bills making such relief from toil obligatory. Austria and Germany have passed such laws and have rendered their application possible by providing the financial aid such women need when they stop working. Now the state of war increasing female labor makes all the more necessary the safeguarding the health of our child-bearing women. In Paris there are homes for women in the last weeks of pregnancy, and experience has shown their good effect upon the new-born children and the mothers. But our maternities should do this and more—they should be open for the reception of ill pregnant women, or those with ill fetuses, with a view of the thorough scientific study and investigation of the diseases of gestation and of the unborn fetus, and the discovery of means of prevention, cure, or amelioration. This is the "prematernity" of Ballantyne.

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## CHAPTER XVIII

### THE DIAGNOSIS OF PREGNANCY

CERTAINTY in the diagnosis of pregnancy cannot always be attained, but a high degree of probability can be reached. This most common condition, which any woman thinks she could diagnose with ease, may, after skilful application of all the means of investigation, assisted by long experience, and studied with a view to careful judgment, escape discovery or be mistaken for something entirely different. While we will admit that error may not always be avoided, it is also true that blunders are more often due to carelessness in making the examination, and lack of consideration of all the facts learned by it, than to ignorance. Socrates said that in studying ourselves, we should "lay aside prejudice, passion, and sloth," an axiom which could well apply to the diagnosis of pregnancy.

Sometimes the diagnosis may be made very quickly, but the accoucheur is bound to guard his statements, because the people believe the fact of pregnancy would be very patent and will discredit the physician if the event prove him wrong, and, further, much depends on his decision. The question of heritage of property, prosecution at law of women accused of crime, of an illegitimate conception, whereby the fair name of a woman may be blasted, of legitimacy of offspring; the proper treatment of disease, as tuberculosis, cancer—all these depend on the correctness of his opinion, and mistakes are very disastrous to both mother and child.

The difficulties are greater in the first four months, before the fetus is large enough so that we can hear it or feel it, but sometimes the question of pregnancy is unsettled until the time for eventual delivery.

In uncomplicated cases, where only the question of pregnancy arises, the patient is more likely to be pronounced pregnant when really not so, but when it is to be determined whether pregnancy complicates some other pelvic condition or simulates something else, the pregnancy is more apt to be overlooked. Thus in operating for fibroids the surgeon is occasionally surprised by finding a pregnant uterus.

**Sources of Error.**—In the early months there is no absolute sign of pregnancy. The character of a gravid uterus can be perfectly mimicked by several other conditions. In the later months the positive signs, the fetal heart-tones and movements, may be absent, the child being dead or the perception of the movements being interfered with. The patient herself may render the examination nugatory; she may be too fat; have, in addition to pregnancy, a tumor, ascites, excessive tympany, etc., or she may hold the abdominal walls and perineum so rigid that the accoucheur can feel nothing in the pelvis. This may be due to nervousness or tenderness in the belly, or it may be practised with intention to deceive. Another source of error is deliberate falsifying by the patient. If she is pregnant, she may desire to conceal in order to get the accoucheur, unwittingly, to produce abortion, either with medicine given for amenorrhea or by passing a sound into the uterus for diagnostic purposes. When not gravid, she may desire a positive opinion of pregnancy in order to perform blackmail or institute bastardy proceedings, or to acquire an estate, in the case of a widow being left property on the birth of a posthumous child. Under these circumstances she will declare all the symptoms of pregnancy to exist, and may even try to imitate the fetal movements by contractions of the abdominal walls. On the other hand, the accoucheur cannot always accept the statements of the patient as true, because she may even delude herself into believing she is preg-

nant. When approaching the menopause, especially if childless, women sometimes imagine themselves pregnant. The abdomen enlarges, the menses cease, they feel the movements of a child, and even go into labor, having pains. Pseudocyesis, spurious pregnancy, "grossesse nerveuse," as the disease is called, has even baffled the diagnostic ability of the ablest surgeons and accoucheurs. It is famous in history (see Montgomery), and exists in the animals—dogs, mares, and pigs.

For materials on which to build a diagnosis of pregnancy we must review those changes of the maternal organism wrought by conception which were considered in the Physiology of Gestation, for a minute study of which the reader is referred to that chapter. As in the discussion of a disease, we divide the findings into two groups—first, those which the patient tells of, called "symptoms," and those which the examiner himself discovers, called "signs." Symptoms are subjective or rational. Signs are objective or sensible. In general, in medicine, it is wise to adhere to objectivity, for then the chances of error are reduced, the suggestion element of the patient being removed. Subjective symptoms have, therefore, little value, and an opinion based on them, at best, is presumptive. Objective signs have greater value and may allow a probable or unequivocal opinion of pregnancy. Montgomery suggested such a division of the proofs of pregnancy—presumptive, probable, and unequivocal. It is wise to pursue a definite scheme in eliciting the proofs of pregnancy, then to assign to each one its proper valuation, and to compare it with the supposed time of conception. The order of appearance of the various phenomena of gestation, their mutual relations in time and severity, and the length of their existence—all these give valuable information for the determination of pregnancy, since irregularities from the typical course should lead to discovery of the causative anomaly. For purpose of study and practice the pregnancy is divided into three periods of three months each, that is, three trimesters.

### FIRST TRIMESTER—SUBJECTIVE SYMPTOMS

**Cessation of Menstruation.**—This is one of the two really important symptoms of pregnancy, but to have value it must occur in a woman previously regular—it must persist until the time of examination. There may be no pathogenic cause for the amenorrhea and no disease may result from it. Three fallacies underlie this symptom:

A. Pregnancy may occur without menstruation: (a) As in a girl before puberty; (b) during the amenorrhea of lactation, or (c) amenorrhea from other causes, as heart disease, tuberculosis, the stress of war (Dietrich, Pok), and from no cause at all; (d) after curetage; (e) after the menopause. Several cases are on record where a woman conceived before the menses appeared, conceived again during the amenorrhea of lactation, and thus the reproductive cycle repeated itself several times without the appearance of the menses for years. Cases of conception occurring during lactation are so frequent that the popular idea of the preventive effect of nursing should be dropped. Pregnancies occurring two, even four, years after the climacteric have been reported.

B. Menstruation may continue after conception. It is not rare to learn of a woman having one or two periods after she is surely pregnant, but usually the amount of blood is small and the character of the flow otherwise abnormal. If the conception occurred just before the menses were due, there may be an abortive menstruation at the proper time. That a true menstrual flow could occur is possible, because the two deciduæ do not fuse until the fifth month. A double uterus may menstruate from the unimpregnated half. Instances where a normal menstruation persisted during the nine months have been reported by Caruso and Pettay. The older writers cite cases where the periods appeared only during pregnancy. That the ovary sometimes continues to functionate during gestation is highly probable, as cases of superfetation and of menstrual molimina and autopsies on preg-

women prove. It is wisest, whenever such a discharge of blood occurs, to der it pathologic and to investigate carefully, because usually one of the follow-conditions is causative: abortion, cervical erosions, disease of the endometrium, ne polyp, fibroids, rupture of a varix at any point in the cervical, vaginal, vul-anal, extra-uterine pregnancy, diseases of the ovum, as placenta prævia, myxo-us degeneration of the chorion, etc.

C. Other conditions may cause the amenorrhea: (a) Change of climate or onment, noticeable, for example, in girls coming from Europe. It seldom per-over three months. (b) Mental influence. Fear of conception, as occurs after timate exposure, may cause the menses to cease. A strong emotion may do the . (c) Pathologic conditions, tuberculosis, syphilis, anemia, exposure to cold, ocal disease, atresia of the hymen or the vagina. (d) Some women are habitu-irregular, being amenorrheic for several months at a time, without apparent or any ill health. Occasionally a long interval will interrupt the regular ds, and the flow is likely to be uncertain during lactation and the approach of enopause.

One is reasonably safe in regarding a woman who menstruates perfectly nor-as not pregnant, and also one who can conceive and is otherwise well, and suddenly ceases to flow, as presumably with child.

The value of this symptom is, therefore, only presumptive, but it is useful in ; the date of conception and to determine the time of labor, and must always be l for this purpose.

**The Morning Sickness, or Nausea and Vomiting.**—Among the so-called athetic symptoms, a tendency to nausea, often with vomiting, occurring in the morning, must first be mentioned.

This usually begins after the fourth week, but may show itself earlier, as in a quoted by Montgomery, where, at the end of the week after marriage, the at felt squeamish. If the nausea is limited to a certain period of the day, y the morning, is not attended with symptoms of disease, comes on in a woman an conceive and who previously was well, it is highly presumptive of the be-ng of pregnancy.

About one-third of gravidæ have nausea and vomiting as a marked symptom; hird complain of them occasionally or as being inconsiderable, and about one-are free from them entirely. The nausea and vomiting occur earlier, more antly, and more severely in primiparæ than in multiparæ. They recur in suc-ug pregnancies, though usually in lighter form. Women of nervous, high-g temperaments suffer more than those of the lower and hard-working classes. symptom is further of value in that its continuance renders probable the life of us, it having been observed that when the child dies the vomiting ceases. As all see when we come to discuss the pathology of pregnancy, the nausea and ting are probably of a toxemic nature. By the time of quickening the stomach ally settled. The value of this symptom is only presumptive, because there are any other causes for stomach disturbances. It seems that many irritations in elvis, tumors, pelvic peritonitis, salpingitis, and appendicitis, may cause them.

**Salivation.**—A slight increase of saliva is a not infrequent accompaniment of ausea, and has the same cause, probably a toxemia. Dewees called it "cotton ng," and, occurring in a healthy woman, unattended with fœtor ex ore or other of mercurialization, it has some slight value in the diagnosis of pregnancy, h it may occur in other uterine conditions and hysteria. There is a gingivitis occurs at this period, with salivation, loosening of the teeth, bleeding from ums, etc., which is distinctly pathologic, and will be considered in the Pathology egnancy, as also will the profuse salivation, an exaggeration of the above tom.

**Change in disposition,** the feeling of being pregnant, various neuralgias, and

other subjective symptoms are unreliable in a serious diagnosis, because they can all be auto-suggested by the patient, especially if she is yearning for a child. However, when an intelligent multipara, having missed a period, believes she is pregnant, one must attach at least presumptive value to the symptom.

The tingling and even shooting pains in the breasts, with their enlargement, also serve to draw the physician's attention to the possibility of pregnancy.

**Irritability of the Bladder and Symptoms of Pelvic Congestion.**—The pregnant uterus does not weigh heavily on the bladder because its specific gravity is about the same as that of the intestines, but the anteversion of the fundus throws the cervix toward the hollow of the sacrum and stretches the base of the bladder, causing the frequency of urination so often mentioned by *gravida* in the first trimester. Later, when the fundus comes to be supported by the abdominal wall, the cause and the symptom disappear. The softening of the parts and the congestion of the pelvis lead to a leukorrhea of which the patient complains only if there was previously some catarrh of the organs, which catarrh is usually much aggravated by the pregnancy. The value of these two symptoms is obviously only presumptive.

### OBJECTIVE SIGNS—FIRST TRIMESTER

**The Breasts.**—As early as the fourth week there may be some enlargement of the breasts, and often the patient notices a tingling or burning sensation in them. The enlargement progresses from periphery to center, and continues throughout pregnancy, though not evenly. *Lineæ albicantes* or *striæ gravidarum* appear on them, and blue veins may be seen coursing under the thin skin, especially near the nipple. The nipple darkens and becomes more sensitive and erectile; the primary areola darkens and becomes puffy, as if there were air under the skin. One may sometimes feel the sinuses lactiferi in the areola. The tubercles of Montgomery enlarge, and occasionally, even in the first trimester, on pressure, a fine stream of colostrum may be expressed from them. They may connect with the sinuses lactiferi. These tubercles not seldom become infected during pregnancy or the puerperium. Around the areola, especially in brunets, there often develops another pigmented area—the secondary areola. It is lighter in shade than the pigmentation of the primary areola, and resembles dusty paper on which water has been sprinkled, an effect due to the absence of coloring around the sweat-glands. The nipple and primary areola are often covered with branny scales, made up of dried sebaceous matter and epithelium. The epithelium of the areola sometimes exfoliates, carrying the pigment with it, showing that the latter is deposited in the deeper epidermal layers. Much of the coloring disappears after weaning of the baby, but, especially in brunets, more or less remains permanently.

Colostrum may be expressed from the nipple as early as the twelfth week, but it may not be present until after delivery. Of these findings, the most significant is the change in the areola, the deepened color, and the puffiness. All the signs are more marked in primiparae, as in multiparae traces often hold over from previous pregnancies. The breast signs have no value in an old multipara as the breasts are enlarged and often contain milk for years. Aside from these fallacies—(1) neurotic women may have tingling in the breasts, enlargement of the areola, and even colostrum during the menstrual periods. (2) Cases of pseudocyesis may show all the signs. (3) Prostitutes and masturbators not seldom show the signs, especially if they have pelvic disease. (4) The breast changes have been observed in cases of ovarian cyst, fibroids, hematometra. It must be admitted that under these circumstances the findings are not so typical, but their occurrence in other conditions than of pregnancy lowers the value of the sign. Especially is the presence of colostrum deceptive. It occurs in neurotic women, even if unmarried, and in men, and the lower animals not pregnant Gardlund. Cases are on record where girls have



suckled infants, the breast being stimulated by irritating poultices and suction, and men have nursed children (Tanner). The value of this sign, therefore, is presumptive, and, if the changes are all marked and typical, which usually occurs about the fifth month, the pregnancy might be said to be probable, but at this time there are other certain signs.

It serves to call attention to the necessity of a pelvic examination. During lactation a sudden diminution of the quantity and alteration of the quality of the milk, which usually produce effects on the nursing, are suggestive of the existence of a new pregnancy.

**Bluish Discoloration of the Vulva, Vestibule, and Vagina.**—Jacquemin, in 1836, discovered this bluish, dusky hue of the vestibule and anterior wall of the vagina, but Chadwick, in 1886, emphasized its importance. The sign is named after both these men. It is usually most marked around the meatus and in the vestibule, extending up the anterior vaginal wall, and is likened to the color of the lees of wine



FIG. 284.—HEGAR'S SIGN. USUAL METHOD.

—that is, an opaque, bluish tint with a tendency to violet. It appears about the eighth to the twelfth week, and becomes more marked as pregnancy advances. It is more marked in multiparæ than in primiparæ, in women with catarrhal or other disease of the genitalia, and in those with contracted pelvis, especially if they have had previous hard deliveries. It is almost always present, but may not appear until very late, and in rare cases not at all. It often disappears if abortion, with hemorrhage, begins and if the ovum is blighted. Since the discoloration is essentially a local venous congestion, it may be simulated by other conditions which may cause the latter—for example, menstruation, rapidly growing pelvic tumors of all kinds, displacements of the uterus, residua of previous pelvic inflammation which disturb



til the tenth week, disappearing when the uterus attains a size and height which make the part inaccessible.

When well marked and typical, the sign is highly presumptive and one of the most reliable of the first trimester, but that is all. The author has found the isthmus very soft and compressible in many cases months after an abortion or labor, in congested uteri, chronic pelvic peritonitis, and occasionally just before and during menstruation. The findings may be imitated by a retroflexed uterus, the angle of flexion being soft, and by a fibroid in the uterine wall. Indeed, the isthmus may be so softened and elongated that the cervix has been held for the whole non-pregnant uterus and the pregnant fundus has been diagnosed as a tumor of the uterus or an exometria. On the other hand, even in pregnancy, the sign may be absent or very slightly marked, or, owing to fat or rigidity of the parts, it cannot be elicited.

**Changes in Form, Size, Consistence, and Position of the Uterus.**—These have been described in the Physiology of Pregnancy and Local Changes (p. 71).

(a) *Form.*—The change from the thin pear shape of the virgin uterus to the rounded, plump, bulbous form, is very noticeable. If the ovum nests very near to



FIG. 286.—FLATTENING AND LENGTHENING OF UTERUS IN EARLY PREGNANCY.

the entrance of one tube, that half of the uterus will develop first and give the fundus that asymmetry, and it might lead to a false diagnosis of extra-uterine or cornual pregnancy (Fig. 347). (See Ectopic Pregnancy.) It is called "*grossesse angulaire*" in French. In the later development of the ovum the symmetry is reestablished. Early in pregnancy one lateral half is thicker than the other, or either the anterior or the posterior wall of the uterus is bulged outward more, these variations being due to the location of the ovum (Fig. 286). Toward the end of this trimester the bulging of the fundus at the sides, above the relatively small cervix, may be appreciated by the finger placed in the lateral fornices.

(b) *Size.*—Every enlargement of the uterus gives rise to the suspicion of pregnancy, and steady increase in size is one of the most valuable signs we have, but at

are developed to reduce these foreign bodies. The existence of such ferments can be demonstrated in the blood of the pregnant woman. The presence of the placenta has evoked them, and if we can show that her blood contains them, it is logical to assume that she harbors a placenta, *i. e.*, is pregnant. This is one of the results of Abderhalden's work, a serodiagnosis for pregnancy.

In brief, the Abderhalden test is as follows: A fresh piece of human placenta is washed free from blood and then coagulated by boiling. It is covered with the pure blood-serum of the woman to be tested, in a dialysing tube or sac, which is hung in a vessel of distilled water. After dialysation in the incubator at body heat has proceeded for sixteen hours, the dialysate is tested for protein derivatives (peptones and amino-acids) by means of the biuret test or ninhydrin, which gives a blue color if they are present, indicating that the placenta albumin has been reduced. The blood-serum of a non-pregnant woman would not have digested the piece of placenta in the dialysation tube.

As simple as the principle of the test is, so complicated and exacting are the details of its operation, only experienced laboratory workers may be trusted to make it, and they must have much practice before their results are clinically useful. Abderhalden claims that errors of technic explain the uncertain results of most experimenters with this method. For this reason the details are here omitted, and the reader referred to Jellinghaus and Losee and Henry Schwarz for a complete exposition of the method.

Abderhalden also tests for pregnancy by a polarization method. He mixes the serum with a solution of placental peptone. Decomposition of this peptone is shown by a change in the optical rotary power of the mixture when studied with his specially devised polarimeter.

The discovery of protective ferments in the blood will permit us to assume that other products of biologic changes, not normal to the individual, exist in it. Thus the proof of a ferment in the serum which will digest carcinoma indicates that the patient is cancerous. In a case of pregnancy, which gave a faint reaction, Abderhalden found that the blood-serum digested liver and kidney tissue readily; the patient had nephritis. Another serum digested thyroid and ovarian tissue, but not liver and testicle—a case of Basedow's disease. The immensity of the field that such tests and studies open up is incomprehensible.

The reaction appears within four weeks after conception, it weakens toward the end of pregnancy, grows stronger after delivery, but has gone by the fourteenth day. The great question is whether the test is specific, *i. e.*, does the serum, for example, of a pregnant woman decompose also other albumins than placenta? Flatow, Kämmerer, Fried, Stephan, Bacon, Falls, King, van Slyke, Losee, and others say that the test is not specific. Jellinghaus, Judd, Schlimpert, Stange, Schwartz, and others agree with Abderhalden, who claims that errors in technic explain the findings of the objectors. The pregnancy test has, it is said, been found in carcinoma, myoma, pus-tube, pneumonia, in the premenstrual days, after a full meal, and it may fail in pregnancy. This is especially true in toxemias, eclampsia, and nephritis, which give the phenomenon an additional interest and importance.

In our laboratory at Northwestern University, Holmes and Nussbaum have found that more or less typical reactions are obtained in pyosalpinx and myomata, but it was present in all the pregnant women examined.

It seems, therefore, that little of practical value is gained from this complicated biochemical test. If it is negative in the hands of a competent chemist, it speaks against pregnancy, but not absolutely. If it is strongly positive, in a case of doubt one might lean a little toward the diagnosis of pregnancy.

Engelhorn claims to have demonstrated a specific sensitization of the pregnant woman against placenta extract—placentin, by inoculating it on the skin—similarly to the tuberculin and luetin reactions. Only one contradictory finding in one

hundred and twenty-three tests, and the placentin skin reaction was present from the seventh week to three or four days postpartum.

Other tests for pregnancy that at least deserve mention are: the antitrypsin test of Rosenthal, the complement-fixation test of Fieux and Mauriac, the miastagmin reaction of Ascoli, and the eiphanin reaction.

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## CHAPTER XIX

### SYMPTOMS AND SIGNS OF THE SECOND AND THIRD TRIMESTERS

**DURING** the second three months of pregnancy there is usually a subsidence of the symptoms called sympathetic,—the nausea and vomiting, salivation, neuralgias, and the irritability of the bladder,—with an increase of the mechanical symptoms. Menstruation is still absent, and a new subjective symptom develops—the patient feels the motion of the child.

**Quickening.**—About the sixteenth to the eighteenth week the woman begins to feel something in the abdomen, entirely unlike any previous sensation. It is said to resemble the fluttering of a tiny bird in the hand. It usually takes her a week to determine what it is, and finally she concludes it is the movement of the child within her. She is usually beset with various emotions, especially if this be her nature, and immediately feels the full glory of maternity. “Quickening” is the term applied to the first perception of the active fetal movements, and is a relic of the barbarous time when the ovum was considered inanimate until it was felt. The law reflected this belief and, until recently, a woman could be hanged for murder if she had not “felt life,” or “quickened,” and the innocent babe thus executed too.

Fetal movements are felt earlier by women who have felt them before, and thus have learned to recognize the faint impulses, and cases are recorded of “feeling life” at ten weeks after conception. The motions may not be sensible until the sixth or seventh month, and in rare instances not at all throughout pregnancy. The author had one such case where, in two pregnancies, the child was never felt and was born well at term. The movements, which are weak at first and later stronger, may be so vigorous that the patient’s rest is disturbed, or they may be very sluggish throughout pregnancy. Rest, warmth, and narcotics diminish the motion; their opposites increase them. A shock, physical or mental, may abolish the movements for a time, even if the child is well. The motion may also cease, without cause, for periods of days or weeks. Hunger and fever at first stimulate the fetus; later, paralyze it. As a symptom of pregnancy, the quickening is of but presumptive value, because the mother, if she desires offspring, only too easily imagines the sensation. Fetal movements are declared in nearly every case of pseudocyesis. Montgomery refers to the famous case of Queen Mary, whose disappointment on learning that her fancied fetal movements were only the signs of a beginning dropsy, caused her to instigate terrible persecutions of the Protestants. Active intestinal peristalsis gives the patient the impression of the movements of a child, as also may contraction of the recti muscles, a tumor in the belly falling from side to side, and contractions of portions or all of the uterine wall when there is a fetus, but it is dead.

One may use the symptom for diagnosis in intelligent women who are without motive for deception. It may serve as a sort of check on the date of the last menses, in determining the length of pregnancy. In primiparæ, count twenty-two weeks ahead to find the probable date of confinement; in a multipara, twenty-four weeks.

### OBJECTIVE SIGNS—SECOND TRIMESTER

Owing to the presence of positive signs, the diagnosis of pregnancy may be affirmed during this trimester. Although some authors assert that conditions exist here one must wait until the physiologic end of gestation arrives for a sure diagnosis, the writer has never met such a case.

on her side, allowing the uterine tumor to hang over. A stroke on the uterus from below is now given—a very uncertain procedure.

Ballottement may be simulated by an anteverted uterus floating in ascitic fluid, a fibroid or ovarian tumor with long pedicle in the same, and a stone in the bladder. It, therefore, becomes a positive sign of pregnancy only when these three are excluded.

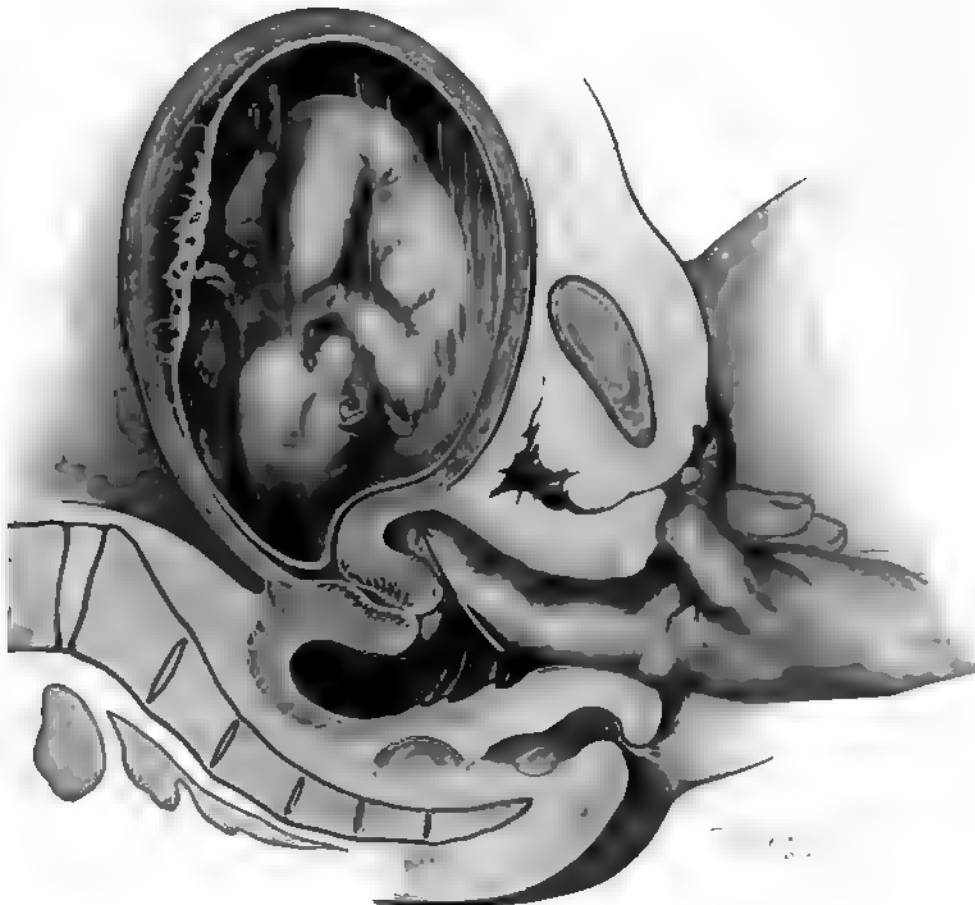


FIG. 287.—BALLOTTEMENT. HEAD RETURNING TO FINGER.

**Direct Palpation of the Fetal Body.**—This sign depends entirely on the skill of the observer. On palpating an enlarged uterus one will feel a hard body with parts which resemble the head or extremities of a fetus, but one must avoid hasty conclusions.

Fetal parts may be discovered as early as the fourth month, and as the child grows more and more, can be differentiated, so that later we can distinguish "large parts"—head and breech—and "small parts"—the extremities. Lumps of feces in the sigmoid, carcinoma of the peritoneum, sarcoma of the ovaries, tumors of theomentum, fibroids of the uterus, can all assume shapes and positions which would mislead a careless observer. The absence of fetal parts, in a case of pregnancy where they should be felt, will lead to the suspicion of a blighted ovum or polyhydramnion.

**Auscultatory Signs.**—*The Fetal Heart-tones.*—Mayor, of Geneva, in 1818, described the fetal heart-tones, but it is believed (Fasbender) that they were first heard by Philip le Goust, in 1650. Lejumeau de Kergaradec, in 1822, published a monograph on the subject which is classic, and but little has been added to our

knowledge since. Both observers were listening to discover the sounds made by the fetus splashing in the liquor amnii. Depaul heard the heart-tones as early as the eleventh week, but usually one finds them first in the fifth month of gestation, though it often requires close application and favorable external conditions, even at this time. At first faint, the beat becomes stronger as the child grows larger. When nearer to the abdominal wall, the sound is heard better, also through a thin wall, and when the baby's back is directed anteriorly. A large amount of liquor amnii, the placenta lying in front, the uterine bruit, rumbling gas in the bowels, and external noise all easily extinguish the sound.

The fetal heart-tones resemble the tick-tack of a watch heard by the ear through a pillow; tick—short pause, tack—long pause. The first sound is isochronous with the systole of the heart and with the pulse in the umbilical arteries; the second sound is due to the closure of the semilunar valves.

The rapidity of the beat normally varies from 120 to 160 per minute, the usual range being 132 to 144. Mention has been made of the supposed influence of sex, and experience does seem to show that girls' hearts beat faster than boys', but the knowledge is of little value in practice. Marked variations in rapidity of the heart-beat occur without cause, the count running up to 180 even, and then subsiding. Fetal movements accelerate the beat; palpation of the fetal body does the same. Fever, fasting, asphyxia, and hemorrhage increase the rapidity of the heart. Uterine contraction, pressure on the fetal brain, slow it.

Pestalozza obtained a cardigram of the fetal heart, and the writer has felt it beat through the abdominal wall in a case of face presentation, an experience reported by others also.

*Methods of Examination.*—The naked ear, the monaural stethoscope, and the binaural stethoscope all give good results. One will use the ear when without an instrument, and in places where rumbling exterior noises interfere, but it is disagreeable to patient and examiner. A constrained position should be avoided, because this produces circulatory noises in the middle ear, and a smooth towel must always be laid between the ear and the skin.

The monaural stethoscope (Fig. 288) made of metal is very useful, because it can be easily sterilized (as with the instruments before an operation), and pressure toward the fetus may be made with it by the head, thus diminishing the thickness of the intervening structures. Best of all is the binaural stethoscope with a large bell. This should be made all of metal and rubber, so that it may be boiled with the instruments for obstetric operations. During auscultation, nothing may touch the instrument save the skin of the patient and the ear of the examiner. Pressure with the fingers causes a faint hum, which often completely covers the sounds. To prevent this muscular hum and the sliding of the bell an expedient (Fig. 289) may be adopted—the bell is held firmly by means of a rubber band. Best of all is the head stethoscope shown in Fig. 309a.

The patient is comfortably arranged at the side of the bed or on a table, and appropriately draped, exposing the abdomen. In doubtful cases the night-time should be selected, and all exterior noises rigidly excluded. Up to the fifth month, the stethoscope should be placed in the median line at the edge of the pubic hair. When the child is palpable, one will be able to determine where the heart is located and listen there. It may be necessary to push the child against the abdominal wall with the hand, so as to bring its heart nearer the stethoscope.

The fetal heart-tones are the most reliable sign we have for the diagnosis of pregnancy. Unless the mother's heart-beat is transmitted to the lower abdomen and has the same rapidity (fever, Basedow's disease), there is no question about the existence of a child in the belly. By feeling the mother's pulse while listening over the uterus, and noting the difference, 72 and 140, and by following the line of increasing intensity of the sounds, the sign is easily proved.

*The Fetal Souffle.*—This is sometimes called the funic souffle, a name given to it by its discoverer, Evory Kennedy, in 1833. It is due to the rush of blood through the umbilical arteries, and is heard when they are subject to pressure or torsion or tension, for example, coiling of the cord around the neck, cord too short, between the back of child and abdominal wall, and under compression by the stethoscope. In thin women the writer has felt the cord coursing over the fetal back. In fetal heart disease one hears cardiac murmurs with the usual fetal heart-tones. These murmurs may disappear after delivery, or, if the disease is organic, be permanent.

The fetal souffle is a soft, blowing murmur heard with the first sound, but it may be with both, or even diastolic. It occurs in about 15 per cent. of pregnant women, being more common during labor. When present, this sign is diagnostic of pregnancy.

*The Uterine Souffle.*—Kergaradec, in his paper (1822), described a sound which he heard while listening at the sides of the uterus, and he ascribed it to the rushing of blood through the placenta, calling it the "placental souffle." It is a soft, blowing sound, synchronous with the maternal heart, having a rushing character, similar to the bruit heard in an aneurysm or in the veins of the neck, or like the French



FIG. 288.—MONAURAL STETHOSCOPE OF ALUMINUM.  
Can be boiled for use during labor.

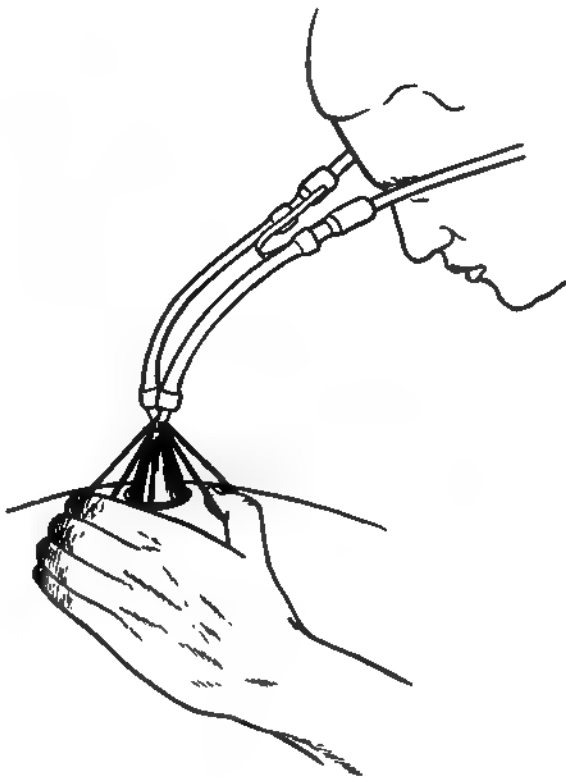


FIG. 289.—STEADYING THE STETHOSCOPE WITH A RUBBER BAND.  
The latter absorbs the muscular vibrations and prevents the humming.

"vous," pronounced in a low, blowing tone—"voo." During uterine contraction it is diminished or altered in quality; sometimes both.

It is heard best at the left side of the uterus, low down, but may be heard on the right side or anteriorly—occasionally all over the uterus, or on both sides.

It may be loud, drowning the fetal heart-tones, or soft, hardly audible—even absent in some (10 per cent.) cases. It may be heard at one time and be absent in the same place later. It may disappear during the examination.

In character it is humming, blowing, rushing, sibilant, or even musical. It may be continuous or intermittent or wavy. It is without shock, and is usually single, but may be both systolic and diastolic. Sometimes pressure with the stethoscope intensifies the sound and alters its character, and one may feel the rush of the blood at the side of the uterus with the fingers as a systolic, fine vibrant thrill.

The origin of the sound is in the large vessels,—arteries and veins in the side of the uterus,—and its similarity to the sound of a varicose aneurysm is striking. It is not in the placenta because it has been heard after the placenta is removed and at locations far from the placental site. It seems loudest near the placental site. There is no sound by which we can locate the placenta, though in early pregnancy a marked uterine souffle will serve to indicate the location of the ovum in the belly. The sound does not come from compression of the



FIG. 290.—X-RAY OF PREGNANCY ABOUT SIX MONTHS. SLIGHTLY RETOUCHEE (taken by O'Donnell, C.)

arteries by the uterus, because it is heard with the patient in the knee-chest position and before the uterus has a chance to compress them.

Depaul has discovered the uterine souffle as early as the twelfth week, but observers have not heard it until the sixteenth week. It is found whether the fetus is alive or dead, but usually diminished in the latter case.

As a diagnostic sign of pregnancy its value is only probable, because it is heard over all rapidly growing tumors—fibroids, ovarian cysts, even in en-



spleen and liver, and in cases of anemia and maternal heart disease, the cardiac murmurs being transmitted.

**Changes in Form, Size, Consistence, and Position of the Uterus.**—These have already been considered under the Physiology of Pregnancy. In the diagnosis of pregnancy the shape of the uterine tumor, its size for the supposed length of gestation, the consistence and location—all these are hardly imitated by any other condition: the practised hand, with one grasp, can usually get enough information for a decision. Any doubt will be set at rest by determining the rate of growth of the uterus, when examined at intervals of three to four weeks. No other tumor grows so rapidly nor so typically. A peculiar phenomenon that is as yet unexplained, and which may confuse the diagnosis, is a sudden enlargement of the uterus to the size of one several months longer pregnant, and then, as sudden, a subsidence to the natural size. It is referred to by Buettner and Dickinson. In the author's case it very materially complicated the diagnosis. Should the uterus cease growing uniformly, or even get smaller, the ovum is probably blighted.

These signs, together, give us positive information of pregnancy.

**Changes in the Skin.**—Pigmentation; the mask of pregnancy; the *striae gravidarum*; the changes in the navel—at first retracted, then pouting, then drawn up; the varicose veins—all these are significant, but have little real diagnostic value.

O'Donnell, of Chicago, in 1911, demonstrated an x-ray picture of a woman six months pregnant. It is reproduced herewith.

Abderhalden's pregnancy test was fully discussed in the last chapter.

### SYMPTOMS AND SIGNS OF THE THIRD TRIMESTER

The menses continue absent. Any bloody show now is either pathologic or means that labor is beginning. The morning sickness is usually absent. Its persistence or reappearance indicates the necessity for a careful examination of stomach, liver, and kidneys. Rarely, the vomiting is the result of cramping of the stomach by the high uterus. Active fetal movements are a more pronounced symptom, and may harass the mother, but the child usually quiets down as labor becomes imminent.

1. The painless uterine contractions become more and more noticeable as the months go by, until, toward the end of this trimester, the uterus often responds to very slight irritants. In this way the cervix and pelvic structures are prepared for the great dilatation they are about to undergo.

2. The examiner now has no trouble to feel the movements of the child.

3. Ballottement, or percussion, is not obtainable, unless there is a great deal of liquor amnii (polyhydramnion), but partial percussion is easily elicited, especially in breech presentations.

4. Direct palpation of the fetal body is plain, and toward the end of the trimester is the same as during labor. One may now diagnose the presentation and position.

5. The fetal heart-tones are louder and more constant, and one is more likely to hear the funic souffle and active fetal movements.

6. The uterine bruit is more intense and more distributed.

7. The changes in form, size, consistence, and position of the uterus are very marked. These have already been discussed. (See p. 85.)

8. The x-ray will always disclose the fetal skeleton.

Only gross carelessness will explain a mistake in the diagnosis of pregnancy during this trimester. Excessive fat in the abdominal wall, the presence of tumors, anasarca, and general peritonitis, in the author's experience, have caused much difficulty, but have not rendered a working decision impossible.

if the patient menstruated last beginning March 1st, December 8th will be y of labor. In about 60 per cent. of cases this method is correct within eight

**Quickening.** It is customary to count ahead twenty-four weeks in multi-nd twenty-two weeks in primiparæ; but in view of what was said regarding mptom, it is plain that no reliance at all is to be placed on the data obtained. *jective Signs.*—1. Size of the uterine tumor, circumference of the abdomen, of the fundus from the pubis or the navel—all these are valueless measure- since so many conditions may disturb them; for example, the amount of fat



FIG. 291.—ASCERTAINING INTRA-UTERINE LENGTH OF FETUS.  
Photograph at Chicago Lying-in Hospital.

abdominal wall, tumors and gas in the belly, the full bladder or rectum, dramnion, twins, pendulous abdomen, contracted pelvis.

The determination of the size of the fetus gives more certain information, and this we may guess, with a fair amount of accuracy, its age. Direct measurement of the length of the fetus in the uterus, as practised by Ahlfeld (Fig. 291), is possible, and, since the length of the child is our best (but poor at that) guide to its age, frequently make use of this method. In primiparæ one branch of the pelvimeter (sterilized) is placed against the head from the vagina, the other branch against the breech. In multiparæ, since the head usually does not enter the pelvis until labor has begun, one puts the first branch of the pelvimeter over the upper border of the pubic symphysis. By doubling the figure obtained and subtracting the thickness of the soft parts, one arrives at the length of the fetus and thus may deduce the period of the pregnancy. A ten months' child is 50 cm. or of nine months, 46 cm.; eight months, 42 cm.; seven months, 38 cm. Direct measurement of the fetal head has been practised, and Perret has invented a cephalometer for the purpose (Fig. 292). Such an instrument is entirely unnecessary, the ordinary pelvimeter giving equally good results. One first determines the position of the head with reference to the pelvis, and then places the branches of the pelvimeter as nearly as possible in the occipitofrontal diameter. One to two centimeters must be deducted from an oblique measurement to obtain the biparietal diameter, and another centimeter for the thickness of

the abdominal wall. Surprisingly accurate results are obtained, and the value of the procedure increases with experience. In breech and shoulder presentation the head is easily measured, unless labor has begun, but when the head has engaged, it can no longer be properly grasped; then, however, the measurement is not needed. A biparietal diameter of  $7\frac{1}{2}$  cm. means that the child is of about thirty weeks' pregnancy,  $8\frac{1}{2}$  cm., about thirty-four weeks, and  $9\frac{1}{2}$  cm. about forty weeks.

The measurement of the fetal head is especially desirable in cases of contracted pelvis, where the question of the induction of premature labor arises, or of a radical operation at the time of full-term labor.

3. Direct palpation of the fetal body. Long experience will enable the practitioner to guess quite accurately the size and weight of the child in utero, but even if his guess is correct, the information is of little value, because children may vary

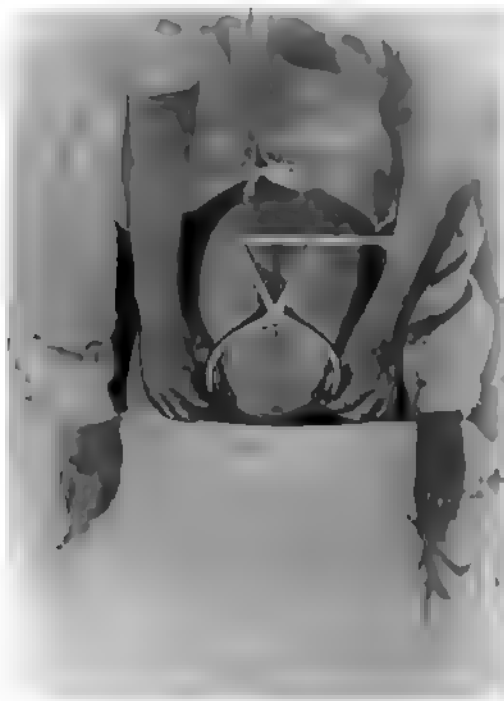


FIG. 202.—USING PERNET'S CEPHALOMETER.  
Any pelvimeter may be used as well. Photograph at Chicago Lying-in Hospital.

so much in size even at identical periods of pregnancy. The author delivered, on the same day, a child at the eighth month of pregnancy which weighed eight pounds, and another, where the mother was three weeks beyond her reckoning, which weighed three and one-half pounds. It has also seemed that the child has periods of slower and quicker growth, similar to those of its extra-uterine existence. Again, the child may have a large head and a small trunk, or vice versa. It is clear, therefore, that all estimations of the period of pregnancy and of the probable date of confinement, based on the size of the fetus, are unreliable.

4. Lightening before labor. It is quite safe to expect the delivery to occur within three weeks from the time the head settles into the pelvis. Often this occurrence is attended by regular uterine contractions which may simulate the real pains of delivery. Schatz has sought to determine the time of labor by a study of

the periodicity of the false pains of the latter months of pregnancy, and by deductions from a study of the variations in the maternal blood-pressure. It has been found that, during pregnancy, daily examinations of the blood-pressure show regular rises which seem to have two types,—a twenty-one-day and a twenty-eight-day type, similar to the usual menstrual periodicity. The false pains of pregnancy seem to occur at the period of the curve where the blood-pressure is highest, and it has been noted, too, that labor occurs at these periods. A determination, with the sphygmomanometer, of the blood-pressure type, in the latter months of pregnancy, therefore, might give some hint as to the day on which labor might be expected.

5. The changes in the lower uterine segment and cervix, as described in the physiology of pregnancy, give only relatively valuable information of the proximity of labor, because they have been observed three to six weeks before delivery, and may remain absent until actual pains have been in operation some time. The extreme sensitiveness of the uterus to external irritation may give a hint as to the nearness of labor.

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## CHAPTER XX

### THE CONDUCT OF LABOR

It is a great satisfaction to the accoucheur to go to the home of the parturient knowing that everything for the proper conduct of labor has been provided and is in readiness. This sense of satisfaction is enhanced if he has with him a case or satchel containing all the instruments and apparatus, dressings, and medicines necessary for the usual case of labor and for the most common complications. What the accoucheur will carry in his obstetric satchel will depend on the conditions of his practice and individual preference. If his patients are on distant farms, he should take with him a complete obstetric armamentarium, which, though heavy



FIG. 293—AUTHOR'S OBSTETRIC SATCHEL. WHITE SUIT AND STETHOSCOPE TAKEN OUT.

and bulky, is necessary if he would give them all the benefits of his art. For a town or city practice, the instruments for the rarer operations—craniotomy, hebotomy, etc.—need not always be carried. It is absolutely essential that the physician be prepared for the operations of perineorrhaphy, forceps, and version, and for the complications, postpartum hemorrhage and asphyxia neonatorum. The author's satchel, for ordinary labor cases, contains the articles on the list subjoined. For complicated cases a separate bag, containing everything for operations from perineorrhaphy to cesarean section, is provided. It weighs 50 pounds and is very bulky, but when the parturient cannot be taken to the hospital operating-room, the operating-room must be taken to the parturient.

## LIST OF ARTICLES IN OBSTETRIC SATCHEL (FIG. 293).

## FOR ARRIVAL

Two sterile hand-brushes.  
 One surgeon's gown and cap.  
 One white duck suit.  
 Four pairs sterile rubber gloves.  
 Four ounces lysol.  
 Three jars sterile gauze and cotton sponges.  
 Four ounces 95 per cent. alcohol.  
 One bottle bichlorid or sublamin tablets.

## MEDICINES

One quart of ether.  
 One ounce of fluidextract of ergot.  
 Six bulbs of "Ergot Aseptic."  
 Three of adrenalin 1:10,000.  
 Three of hypophysin.  
 Three of sterile camphorated oil.  
 One ounce 1 per cent.  $\text{AgNO}_3$ .  
 A working hypodermic syringe with tablets of morphin and strychnin.

## SUNDRIES

Linen bobbin (sterile) for cord.  
 Six tubes twenty-day catgut No. 2.  
 One wide-mouth jar with sterile silk gut.  
 C. P. sodium bicarbonate for boiling instruments.  
 One nickeled copper pan for same.  
 History sheets and cards for physician and nurse.

Birth-certificates.  
 Two sterile version slings.  
 Test-tube and reagents for testing albumin and sugar in the urine.

## INSTRUMENTS

One pair Simpson forceps.  
 Two scissors, long and short.  
 Four artery forceps, long and short.  
 Two tissue forceps.  
 Two vulsellum forceps.  
 Two special cervix holders.  
 One long uterine packing forceps.  
 Three broad retractors.  
 One box needles.  
 Two needle-holders.  
 One stethoscope.  
 One silver catheter.  
 One rubber catheter.  
 Two tracheal catheters.  
 One baby scale and tape-measure.  
 One anesthetic mask.  
 One pelvimeter.

## FOR POSTPARTUM HEMORRHAGE

One douche-can and tube.  
 One 12-yard jar lysolized gauze.  
 One 8-yard jar of same.  
 One salt solution needle.  
 Three 2-dram bottles sterilized salt.  
 One tube Merck's sterile gelatin.  
 One tube coagulose.

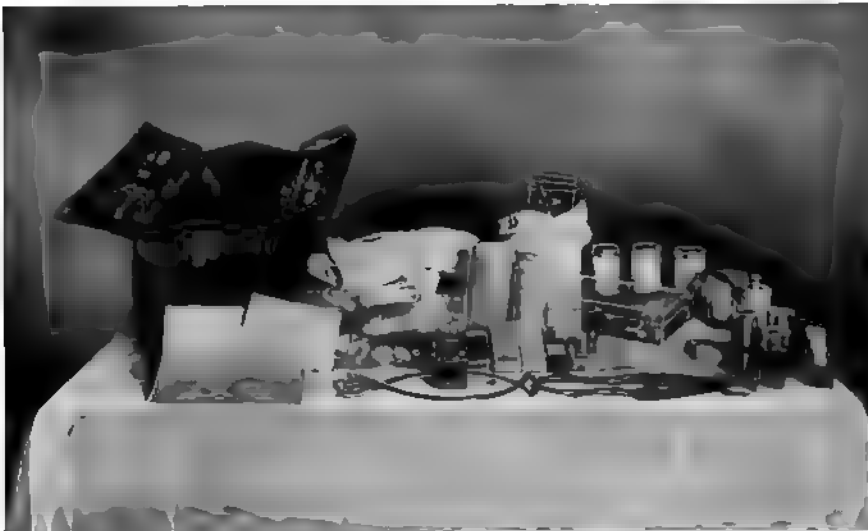


FIG. 294.—CONTENTS OF OBSTETRIC SATCHEL.

Basins and towels are to be found at the patient's house. If they are not, three one-quart cream pans and a package of six sterile towels must be added to the above outfit. All these things can be comfortably packed into a 17-inch "cabin" satchel. The instruments, all but the scissors and stethoscope, are packed in the pan, and are boiled in the same just before they are used. The medicine bottles are held in two bags made of ordinary white cotton duck, washable. Objection has been made to the leather satchel on the score of its becoming infected. This is possible if the physician is careless and allows it to become soiled with blood, etc. No contrivance can be invented to take the place of an aseptic conscience. By exercising care that the satchel is not soiled, by frequently cleaning it with a cloth dampened in alcohol, it may be kept in a safe condition. The instruments are boiled before using, and the aseptic articles are all in hermetically sealed bottles. When the satchel has been exposed to a known infected case, a half-ounce of formalin poured on a towel laid among the bottles, with the lids closed for a few hours, will sterilize it. A separate satchel should be used for infected cases.

**The Question of Assistance.**—A distinction between hospital and home practice in obstetrics is gradually creeping into our scientific discussions. Careful study of existing conditions will convince any one that the safest place for the parturient woman is the special, well-equipped lying-in hospital. Here are all the facilities for the aseptic conduct of labor and the puerperium, here is the danger of child-bed infection properly evaluated, here only are the refinements of an operative technic possible, because the operator has the help of trained assistants. The newer procedures—vaginal cesarean section, hebstectomy, cesarean section and its modifications, the treatment of eclampsia, ruptured uterus, asphyxia neonatorum, the repair of lacerations, etc., all procedures which save life and reduce invalidism—can be carried out immeasurably so much better in the maternity than at home, that one could wish every woman would go to such a hospital for her confinement. That the obviously pathologic case belongs in the hospital cannot even be discussed. Another benefit which is not so generally recognized is the effect on the physician. The maternity relieves him of a great deal of actual labor, it saves him many hours of tedious waiting, it lightens the burden of responsibility, and the knowledge that he is prepared for all emergencies gives him a feeling of security which reflects itself in his work. The drudgery inherent in obstetric practice is thus largely eliminated, and the field becomes more inviting to the best men of the profession. That such a movement will have a marked effect on our obstetric mortality and morbidity tables is self-evident.

But the vast majority of births occur in the patients' homes and will continue so in our day, and it, therefore, becomes our duty to better the conditions we are forced to meet. The people must not expect such good results as are obtained by the accoucheur in his specially equipped maternity, but it is surprising how much may be accomplished, and with simple means. The preparations and the obstetric satchel have been described. It is essential that the accoucheur have sufficient assistants. Every labor case should have two physicians. The duties of the assistant are, first, to watch the fetal heart-tones so that if the child should show signs of exhaustion or asphyxia, it be recognized in time, and the frequency of still-births be thus diminished; second, to keep an accurate history of the labor; third, to care for the patient during the first stage while the accoucheur is attending to other work, or obtaining the rest he will need for the proper conduct of the second and third stages. In this way an impending convulsion, or rupture of the uterus, or internal hemorrhage or any other complications will be discovered early enough for successful treatment; fourth, to give the anesthetic, and assist at eventual operation; fifth, to care for the baby or for the third stage, if the accoucheur is busy

with the baby; sixth, to stay in the house an hour or more after delivery to handle a possible postpartum hemorrhage.

If obstetrics is ever to attain the dignity of surgery,—and it should,—if the parturient woman is ever to enjoy the same benefits as the surgical patient,—and she deserves them,—the accoucheur must be given sufficient help and the makeshift policies of obstetric practice must be abolished.

**Response to the Call.**—The pregnant woman is to be instructed to summon the physician immediately when she feels that labor has begun, or when she thinks that something—anything unusual—has taken place, and the physician should respond at once. If the call comes at a time when he cannot answer, the accoucheur sends his associate or assistant to care for the woman until his arrival. In this way a malpresentation of the child or other complication may be recognized early, at a time favorable for its correction, the preparations for labor may be made (if the patient has no trained nurse), the bowels and bladder properly cared for, and the nervousness of the parturient allayed.

Arrived at the case, the accoucheur immediately begins to throw around the patient all the barriers against infection, and to study all the conditions, with a view to prevention and cure of all possible complications. Part of this study is a test of the urine for albumin, which may very suddenly appear, and a general physical examination,—heart, lungs, etc.,—unless the same has already been made.

**Asepsis and Antisepsis.**—These have reference to, first, the physician; second, the patient; third, the environment, and the same minute attention to detail is required as for an abdominal section. It is a question if the uterus can care for more infection than the peritoneum.

Semmelweis, in 1847, called the attention of the world to *the physician as a carrier of infection*, and the latter's importance in this rôle has been recognized ever since—in fact it is exaggerated, for the public has held him responsible in cases of sepsis when he was not to blame. Cases of infection will occur under ideal conditions, and we must look for the cause elsewhere than in the accoucheur—probably in the woman herself, or even in the husband. The precautions the accoucheur is to take, as far as his work is concerned, are well recognized and ought to be the common property of the profession.

The accoucheur should be of clean personal habits, should not soil his clothes by contact with postmortem tables, pus-basins, contagious disease cases, etc., etc. The accoucheur should not attend contagious diseases, individual favorable experience to the contrary notwithstanding, AND HE MUST SCRUPULOUSLY AVOID GETTING INFECTIVE MATERIAL ON HIS HANDS.

This is the key-note of subjective asepsis and cannot be sufficiently emphasized. All infected things—pus, dressings, etc.—should be handled with forceps and perfect rubber gloves. If the skin of the hands is once infected, it requires two days of frequent scrubblings to obtain relative cleanliness again. No method of hand disinfection will do it at one operation.

**Hand Sterilization.—Fürbringer's Method.**—Pare the finger-nails and remove subungual dirt with a dull instrument. Scrub for five to ten minutes in very hot water with green soap. Soak hands in 95 per cent. alcohol one minute. Soak in bichlorid 1:1000 three minutes. Sublamin is a newer mercury preparation said to injure the hands less than bichlorid and to be as strongly germicidal.

**Amfeld's Hot-Water-Alcohol Method.**—Pare finger-nails and remove subungual dirt. Scrub with soap and hot water for three to five minutes; scrub in 95 per cent. alcohol three to five minutes, using a square of flannel in which the hands are wrapped until ready to examine or operate.

**Halsted's Permanganate-of-potash Method.**—Pare finger-nails, wash hands thoroughly, and remove subungual dirt. Scrub with soap and hot water five to ten minutes, immerse hands and forearms in hot saturated solution of potassium permanganate until stained deep brown. Immerse in saturated solution of oxalic acid until the skin is decolorized. Rinse in sterile water or sterile lime-water. Some surgeons use bichlorid in addition.

While, scientifically, it is impossible absolutely to sterilize the human skin, for practical purposes any one of the above methods, if conscientiously carried out, and



providing the hands have not recently been soiled with virulent septic matter, will prove safe to the patient.

For absolute assurance against carrying infection the accoucheur should always wear rubber gloves in his practice, and these have the further real advantage that, to a great extent, they spare the skin of the hands from the corrosive action of antiseptics. The preservation of a smooth hand with well-groomed finger-nails is an essential item of an aseptic surgical technic. The author has not observed any difference in his results since using rubber gloves, but he invariably uses them because the frequent scrubblings and applications of corroding antiseptic solutions were fast ruining the skin of his hands, and making them harder and harder to sterilize. Other advantages of the gloves are: they prevent the finger-nails from scratching the softened and delicate mucous membrane; they render the examination less painful and distasteful to the woman—the gloves appeal to her sense of the esthetic; finally, beside preserving the hands, the gloves reduce the dangers of infection of the accoucheur by syphilis, pus, etc.

Objections urged against the use of rubber gloves are: they interfere with the sense of touch, making diagnosis more uncertain; they do not permit the use of the finger in puncturing the membranes, in tearing through the placenta where it is pre-vial; and in removing fragments of placenta from the uterine wall when such are adherent; they interfere with instrumentation, rendering operations more difficult and prolonged; they are liable to tears and punctures which then permit perspiration, accumulated in the hand, to escape into the wound.

It is admitted that, at first, the gloves dull the sense of touch, but practice soon restores it, and one can feel as well as before, even though the glove be moderately thick. One exception must be made to this statement. It may be impossible to feel the untorn peritoneum over a ruptured uterus. The removal of fragments of placenta from the uterine wall is rendered possible by wrapping one or two fingers of the operating hand with gauze. (See Fig. 714.) The gloves will interfere very little with instrumentation if they fit well. The makers will, for an insignificant extra charge, make a glove from a model of the accoucheur's hands. This specially fitted glove will hardly prolong an operation, and, further, it is less likely to be torn or punctured. The possibility of injury to the gloves is the only real objection to their use, but this is reducible to a negligible minimum by proper technic. In the first place, the accoucheur must consider every puncture of the glove an error in technic, and throughout the operation must strive to avoid it. After each operation all concerned in it should publicly test the gloves and make note of the number of punctures. Then, too, the operator should dispense, as far as possible, with instruments that are sharp or have teeth—for example, fork retractors, bullet forceps, tenacula. The author, with this point in mind, has had dull instruments made to replace the rat-tooth tissue forceps, the vulsellum forceps, and the rat-tooth artery forceps. The ends of the scissors are blunt, and points, where necessary, are protected as much as possible. As a result of these and other precautions nearly every labor, and many operations—even craniotomy—are performed without injury to the gloves.

An important factor is the use of dry sterile gloves. If the gloves are drawn on over the wet hand, they macerate the skin, favor perspiration, and, if punctured, allow the accumulated secretions to escape readily. The dry glove has not these objections. The puncture of one finger does not communicate with the others, and the amount of secretion that escapes is negligible. In summer the author places a strand of gauze in the palm of the hand, leading it up to the sleeve of the gown at the wrist, as a capillary drain for the sweat. Further, *it is always understood that the hands are habitually kept free from infection and are carefully sterilized before putting on the gloves.* Without gloves, perspiration and scraped-off epithelium from two hands get into the wound; with intact gloves, neither escapes; with a few punctures, only a small portion escapes, and the chances of infection certainly are less than with the bare skin.

The advantages, therefore, of the gloves far outweigh the disadvantages, and their use cannot be too heartily recommended.

White duck trousers and a sterile gown are recommended for wear during normal delivery and obstetric operations. For the hours of waiting, the accoucheur is cleanly attired in a white duck coat. Street dirt and contagion are thus kept from the confinement bed. The head-piece shown in Fig. 780 is used by the author in all obstetrical operations and even normal deliveries. The author believes that spitting upon the puerperal wounds and the sterile instruments, etc., as unavoidably occurs during speaking, is a common cause of infection.

Without doubt the physician carries the greatest danger of infection to the confinement room. The germs in the air, in the bed-clothes, in the patient's garments, even those of the vulva, may be the same in name as those he brings with him, but the former are not virulent, as they usually have been living a saprophytic existence. The physician comes in daily contact with infectious diseases, pus, and erysipelas cases, and his person, clothes, and especially his hands may carry highly virulent organisms.

That everything introduced into the vagina should be absolutely sterile requires no mention. The author does not carry already sterilized instruments to the case because, to insure permanent sterility, the containers must be hermetically sealed, which is impractical. Gauze and sponges in glass jars can be thus carried. Instruments are boiled in 2 per cent. soda, borax, or lysol solution, in a tightly covered vessel, for five minutes just before they are to be used.

**The Asepsis of the Patient.**—Using culture-media very favorable to its growth, Krönig and Pankov have shown that the streptococcus pyogenes exists in 75 per cent. of the vaginas of pregnant women and in nearly all puerperæ. Walthard found pathogenic bacteria in 27 per cent. of the vaginas of pregnant women, and these bacteria could be made virulent by proper cultural methods. The uterus and upper third of the cervix are sterile, but the vagina is often, and the vulva always, infected with non-pathogenic and pathogenic bacteria. Why does not every woman in labor become infected? Why does not "autoinfection" occur more often? Autoinfection means the development of sepsis during the puerperium from germs which existed somewhere in the woman's person at the time of labor. Its existence was recognized by Semmelweis, later denied by many authorities, but recently admitted as possible, but of great rarity, by the majority of students of the subject. The reasons for the rare appearance of infection are: the parturient has developed immunities against the germs which have made the vagina their habitat; the process of labor is a continual scouring out from above, the flow of the liquor amnii, the progress of the child and the placenta, the running of blood, all from above downward, all oppose the upward wandering of the vaginal bacteria; the vaginal mucus has slight bactericidal properties; the bacteria have a low virulence during labor, acquiring invasive properties only after the third day postpartum, but by this time the puerperal wounds are covered by granulations which oppose their attacks.

Let the natural immunities be broken down,—as by severe hemorrhage, shock, eclampsia, etc.,—or let a new virulent bacterium be introduced; let the accoucheur in his manipulations carry too many of the vaginal bacteria up into the uterus (a procedure not entirely avoidable), or let him, by his operations, bruise and mutilate the parts too much, or let him break up the protective granulations above referred to, and the germs will rapidly invade the system, producing a disease known as "puerperal infection," termed by the older writers "child-bed fever."

The asepsis of the patient, therefore, consists mainly in the preservation of her immunities by sustaining her strength, procuring a normal course of labor, avoiding the necessity for operative interference, and conducting these with the least possible amount of damage. By restricting the internal examinations and conducting the labor by external and rectal examination and observation of its course, we avoid

carrying the infective material present in the vagina into the tissues. Rigid asepsis and antisepsis will prevent the access of bacteria from without.

In brief, the two main principles are: Limit the number of the puerperal wounds, and, second, prevent infection of the unavoidable puerperal wounds.

How to carry out these principles will occupy our attention throughout all the chapters devoted to the practical application of the science of obstetrics.

**The Antepartum Bath.**—As generally practised, the preparatory bath given in a tub is dangerous, because the wash-water, with the diluted soil from the body, gets into the vagina. Bacteriologic proof is not necessary to convince one of this fact. Any woman who has had children will know that the water of her bath frequently gains entrance to the vagina. Stroganoff has shown that the morbidity of the maternity in St. Petersburg has improved since the shower was substituted for the tub-bath, and the author recommends the shower in the antepartum preparation. First, the pubic region is carefully shaved, as for a gynecologic operation. A safety razor is best for this purpose. Then the whole body is scrubbed with soap and water. In hospitals a shampoo table is used. The person is then showered with lukewarm water, after which the pudendal region is again scrubbed with soap and hot water, using a wash-cloth (no stiff brush), and paying especial attention to the folds around the clitoris. Accumulated smegma is removed with olive oil, albolene, or soft soap. After the soap has been rinsed off, the region from the umbilicus to the knees is liberally sponged with 1:1500 bichlorid of mercury, again paying especial attention to the pudenda.

Before the bath is given, a colonic flushing of soapy water is administered, and the patient empties her bladder. After the bath, the patient is thoroughly dried with a sterile towel, dressed in sterile night-dress and stockings, with clean slippers and house dress, and conducted to the confinement room.

**The Antepartum Douche.**—Since germs with virulent possibilities are naturally present in the vaginas of parturients, it would seem wise to disinfect the vagina as we do before gynecologic operations. Theoretic consideration and practical experience, however, show that attempts to sterilize the vagina before labor invite the infections we seek to avoid. The scrubbing of the vagina and cervix robs the softened mucous membrane of its protective mucus and epithelium; the strong chemical antiseptics kill the delicate cells before they affect the bacteria. All that the treatment does is to remove some of the germs and the secretions, and within a few hours afterward the germs are as numerous as before. The tissues, however, have sustained permanent injury, and their natural immunities have been reduced. Experience in the Leipzig clinic under Menge, in parallel cases, treated with and without vaginal antisepsis, has shown a higher morbidity in the former class. If vaginal antisepsis were necessary for good results, the Chicago Lying-in Hospital and Dispensary, under the author's management, would show a higher mortality from sepsis than 7 deaths in 23,500 cases. In 2 of these cases sexual intercourse had occurred within a few hours of the delivery of the child, and in one there is question of the diagnosis.

Further, it is as little possible to sterilize the vagina as it is to sterilize the skin. The author does not use antiseptic vaginal douches as a routine. Before operations, just before introducing the hand, the vagina is liberally flushed with 1 per cent. lysol solution squeezed from pledgets of cotton, the idea being to reduce the amount of infectious matter unavoidably carried into the puerperal wounds and up into the uterus by the manipulations.

Under Asepsis of the Patient may be mentioned abstinence from coitus during the last month of pregnancy. The danger of such a bestial practice is a real one, as the two cases just referred to will indicate. In one of these two fatal cases the procedure ruptured the membranes, the infant was born as the medical attendant entered the room, and the rest of the labor was conducted without any internal examinations or treatment whatever.

**Asepsis of the Environment.**—The room selected for the confinement should be light, airy, with good plumbing, and may not have been recently used for a septic case. The air in the ordinary home does not contain any virulent bacteria, but this cannot be said of general hospitals admitting pus cases, pneumonia cases, and tonsillitis patients into the same wards with maternity patients. That under these circumstances puerperal infection may originate has been amply demonstrated to the author. The maternity case should be in a part of the general hospital absolutely isolated from the rest of the wards; better, in a detached pavilion of its own, but best as a separate institution under its own administration.

The confinement room should be cleared of all unnecessary and of upholstered furniture. Heavy hangings, dust accumulators, and rugs should be removed before

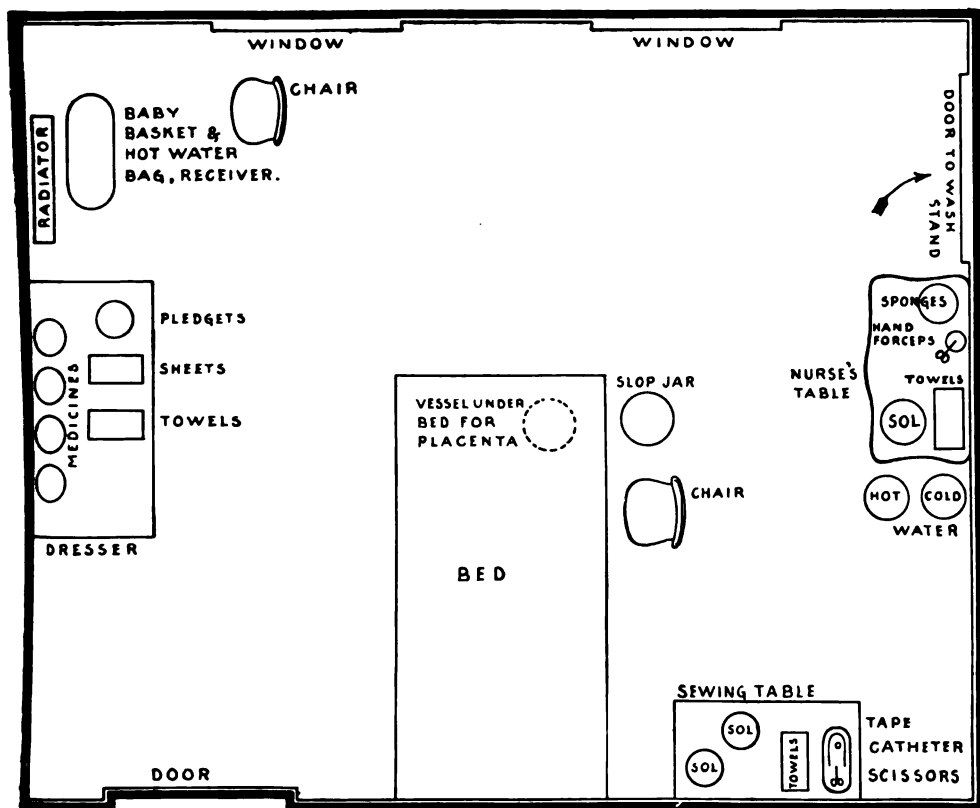


FIG. 295.—DIAGRAM OF ROOM PREPARED FOR CONFINEMENT.

actual labor has commenced. Sufficient provision must also have been made for light, especially for operations at night. The room should be conveniently arranged, some thought having been given to it. Fig. 295 is an example.

The bed, preferably a narrow one, is moved away from the wall. Three table boards or shelves from a book-case are put under the mattress, on top of the spring, to give it a table-like character, and to prevent sagging in the center. The mattress is covered with a long rubber cloth; over this comes a sheet; at the middle of the bed is put a small rubber protector, and over this a sterile sheet, folded once, and all securely pinned with safety-pins. If the patient has no rubber sheeting, the mattress is covered with five layers of clean newspapers, and these also substitute the small rubber sheet under the buttocks. Sterile newspapers are easily procured, and they may be used in many places instead of sterile towels. A large bundle may

be baked in the oven like a loaf of bread. The dresser, side-tables, and chairs on which the solution basins are laid are to be covered with newspapers.

To carry the solution basins, instrument tray, and pile of sterile towels, the ordinary sewing-table serves admirably, additional table room being obtained by means of the ever-present euchre-table. The table from the kitchen or a strong library table is used for all operations. With a degree of effort and forethought the conditions of the lying-in hospital delivery room may be successfully imitated.

**The First Examination.**—On entering the lying-in chamber the accoucheur notices minutely the general appearance of the parturient, the frequency and strength of the pains, takes the pulse, and later the temperature. It is not always



FIG. 296.—IS THE OVOID LONGITUDINAL OR TRANSVERSE?

necessary to proceed to the examination at once: the first few minutes may be devoted to general observations unless the indications point to a quick delivery. The accoucheur then takes off coat and cuffs, rolls sleeves above the elbow, puts on a gown, washes the street-dirt off his hands, cleans his finger-nails carefully, and scrubs his hands and forearms vigorously with soap and hot running or frequent changes of water for five minutes by the clock. The nurse in the meantime prepares the patient for the external examination, bringing her near the side of the bed, uncovering the abdomen, but covering the limbs and chest with a sheet and a towel. The physician dries and warms his hands and proceeds with the abdominal exploration. Five questions must be answered: (1) Is the woman pregnant? (2) How many

children has she had? (3) Is she at term? (4) Is she in labor? (5) Complete diagnosis of the case. The first three questions will have been answered by the pregnancy examinations unless the physician is first called during labor, but let a warning be sounded not to take too much for granted, but to proceed on the safe grounds of a careful physical objective examination. Is the woman in labor? The regular character of the pains, the hardening of the uterus, the show, the proved rupture of the membranes, and the findings on internal examination will determine this point; but labor may cease, even after partial or complete dilatation of the cervix, and pregnancy continue for days or weeks. The pains cease, the os closes, and the incident is called a "false alarm." False pains are painful uterine contractions occurring during the latter part of pregnancy, not followed by dilatation of the cervix or the appearance of a show. They often attend lightening, may occur



FIG. 297.—WHAT IS OVER THE INLET?

at night, not seldom repeat, and may summon the physician and nurse on a fruitless errand. A warm bath and an enema or a dose of bromid will dispel them.

The diagnosis of position and presentation by abdominal examination was first developed by Pinard, and has since been amplified by many authors. One should have a certain plan, which, if followed, will lead to accurate results and prevent omissions. After noting the size and shape of the uterine tumor, the following four questions are answered: (1) Is the uterine ovoid longitudinal or transverse? (2) What is over the inlet? (3) What is in the fundus? (4) Where is the back?

1. *Ovoid, longitudinal, or transverse?* The hands are laid on either side of the belly, and the uterine tumor straightened between them, thus easily determining if the fetal and uterine ovoid lies parallel with the long axis of the mother or not. If it is parallel, the presentation is either head or breech; if not, we are dealing with an oblique or a transverse presentation (Fig. 296).

2. *What is over the inlet?* The two hands are gently pressed into the inlet of the pelvis from the iliac fossæ. If they find a hard, ball-shaped body, it is the head. If they come almost together above the inlet, it means, first, that the head is very

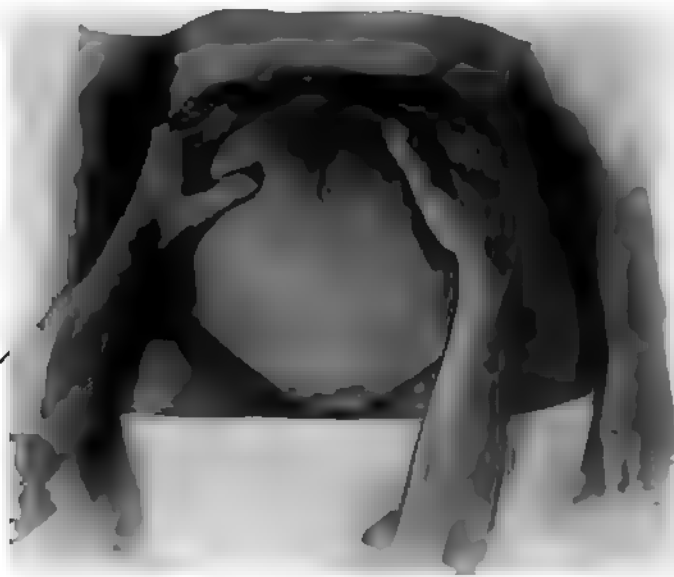


FIG. 298.—WHAT IS IN THE FUNDUS?

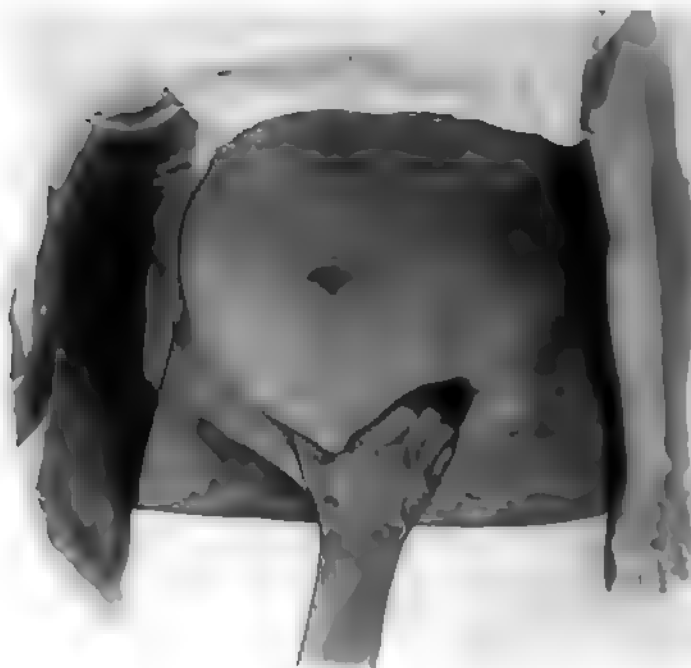


FIG. 299.—GRASPING HEAD WITH ONE HAND IN O.D.P. THUMB SINKS DEEP TO OCCIPUT. FINGERS STRIKE FOREHEAD OVER LEFT RAMUS PUBIS.



**FIG. 300.—PALPATING THE ANTERIOR SHOULDER IN O.L.T.**



reached sooner by the advancing hand, is angular, further from the middle line, an easier outlined. Having thus located these two points, the position of the head becomes clear. The forehead cannot be distinguished from the occiput when the head is deflexed in face presentation; but here we have corrective means of diagnosis. Another method, by a single grasp to palpate the head, is illustrated in Fig. 299. An expert diagnostician may often, with this one grasp, diagnose the presentation, position, and degree of engagement of the head. One determines the position of the head in the pelvis by the relation of the occiput and the forehead to the inlet. If the forehead is felt to the right side behind, and the hand, to reach the



FIG. 301.—FETAL TRIANGLE.

Four fingers of the right hand are laid in the broad base of the triangle and feel the side of the fetus. Pushing upward the thigh is felt, and downward, the arm.

occiput, sinks deeply behind the left ramus of the pubis, the position is O.L.A. if the forehead is over the left pubic ramus, it is O.D.P. Another method of determining position is by locating the shoulder (Fig. 300). One hand passes upward from the rounding of the head and comes to rest on a soft prominence—the shoulder. If this is in the median line or to the right of it, when the back is on the left side, the position is O.L.A.; if to the left of the median line, the position is O.L.T. or O.L.I. and correspondingly when the back is on the right side. Passing upward the hand feels a triangular space (Fig. 301) made by the side of the baby's trunk—the thigh above and the arm below. Still another method of determining the position of the

n the pelvis is the study of the relation of the feet to the breech and the breech quadrants of the fundus (Fig. 302). Careful study of the subject has convinced the author that the breech and trunk very closely follow the movements of the head, so that, for example, if one finds the breech in a position which it would occupy in O.L.P., the head will lie in this position, and, by definitely outlining the fundus, one may deduce the position of the head. The fundus is marked out with a circle and divided into four quadrants. If the breech, with the small parts, is in the left anterior quadrant, the position is occipitolæva anterior, O.L.A.; if in the right posterior quadrant, the head lies O.D.P.

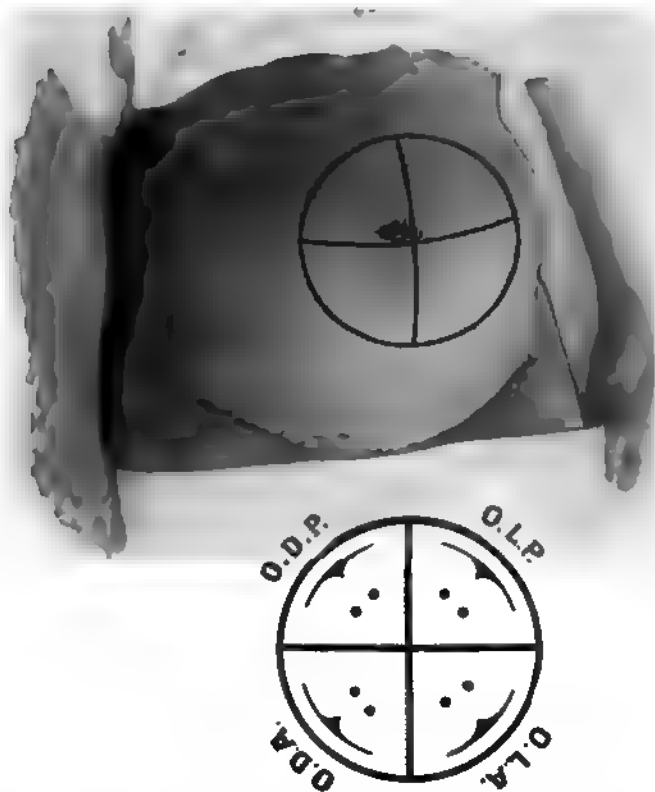


FIG. 302.—THE FOUR FUNDAL SEGMENTS, SHOWING THE POSITION OF THE BREECH IN THE FOUR POSITIONS OF THE HEAD.

*The Engagement of the Presenting Part.*—What is the degree of engagement? How does the head stand?—a most important question, which must be answered many times in every labor. (1) Place the two hands on the head, as in Fig. 297, and try to move the head—or breech—from side to side. If movable, the part is unengaged. (2) Note how much of the head can be felt above the inlet, using the head as a landmark. If only the forehead is palpable, and that on deep pressure, the head is well engaged. Other information is obtained on internal examination. *The Location of the Placenta.*—In a few instances this may be discovered at this time, though, except in cases of placenta prævia and cesarean section, the information is of little value. The placental site has a boggy feel, the parts underneath are soft, and sometimes, if the abdominal wall is thin, one may see a somewhat indented groove on the uterus. When the placenta is on the anterior wall, the round

ligaments are pushed to the sides, and when the organ occupies the posterior wall, the round ligaments converge on the front of the uterus (Figs. 102 and 103, p. 83) (Leopold and Bayer). There are no auscultatory signs which may be used in locating the placenta in the uterus.

The round ligaments, their course, thickness, tenseness, and tenderness, should be studied and noted.

Now the pelvis is measured, unless this has been done before labor (see p. 238), and an opinion is to be formed of the amount of resistance the child will meet. This comprehends the palpation of the child and the formation of a mental picture of its size, also fetal mensuration. It is a good plan to write down the probable weight of the child, to gain experience in estimating.

The presence of tumors in the uterus or abdomen, ascites, tympany, excessive or unusual tenderness, should all be noted. One may feel the umbilical cord coursing over the fetal back or around its neck; also feel unusual fetal movements, as hiccups and gasps; or may determine a fetal anomaly, as hydrocephalus, twins, etc.

*Auscultation.*—It is better to make the diagnosis of presentation and position by abdominal palpation, and confirm it by locating the fetal heart, than to rely on the location of the tones to give the former information, because there are vagaries in the transmission of the heart-sounds which may mislead. Fig. 221, p. 199, shows the location and course, during labor in O.L.A., of the fetal heart-tones, and Fig. 227 the same in O.D.P. As labor progresses, the child advancing and rotating, the point of greatest intensity of the heart-sounds comes anteriorly and sinks, until, when the head is distending the perineum, the sounds will be best heard just over the pubis. The auscultation of the fetal heart gives invaluable information as to the life and condition of the child. Normally, the rate is 120 to 150 a minute, and the beat is regular and rhythmic. Any slowing below 120, or increase above 150, is suspicious of danger threatening the infant, as also is irregularity of the beat or lack of the normal rhythm. This subject will again be considered under the subject of Asphyxia Neonatorum. Suffice to say here that the fetal heart-tones must be studied every hour or two during the first stage of labor, and every fifteen to twenty minutes, or even continuously, in the second stage, for the purpose of early discovering any danger which may beset the infant in utero. One may hear the funic souffle, especially if the cord lies over the fetal back or is coiled around the neck, and, if it is found, still greater caution is required.

Finally, the observer studies the uterine contractions, noting their character, frequency, and strength. The uterus is the engine of delivery, and the physician, as does the engineer, must know the power of the machine that does the work. Too little power, too much power, great power against great resistances—all such problems must be solved by the obstetrician during his observations. The main points in the abdominal examination are:

1. Accurate diagnosis of presentation and position.
2. Determination of the degree of engagement.
3. Condition of the child in utero.
4. Character of the uterine action. The power.
5. Consideration of the pelvic measurements and determination of the size of the child, and the kind and amount of resistance the latter will meet in its passage through the pelvis. The weight and resistance.

A large number of labors can be conducted by means of the information gained by abdominal examination alone, but often we need more, and this will be furnished by rectal exploration. In rare cases, and these are usually pathologic, one will have to resort to vaginal examination, but this method is restricted to a minimum because of the danger of infection, which is a real danger in spite of the employment of the most rigid aseptic technic.

For a complete obstetric diagnosis we wish to take the internal pelvic measure-

ble near the bed—1 : 1500 bichlorid of mercury and 1 per cent. lysol, each basin containing a good supply of cotton pledgets or gauze sponges. The hands are again rubbed for five minutes in running water or frequent changes, soaked for a minute 70 per cent. alcohol, and then for one minute in 1 : 1500 bichlorid. Since the genitalia have already been disinfected, in the primary preparation of the patient the physician needs only to liberally sponge the labia and introitus with lysol solution, then with the bichlorid, and again with the lysol solution, leaving a piece of cotton soaked in the latter lying in the vulvar canal. He now washes his hands again in the bichlorid solution, dries and powders them, and draws on his sterile rubber gloves. The talcum powder, which coats the gloves during sterilization, is washed off in the two antiseptic solutions, and then two fingers of the left hand—taking care to touch nothing on the way—are carried to the vulva, removing the bit of cotton left there. Then, separating the labia widely with the index and middle finger of the other hand, the two fingers enter the vagina, passing at once deeply



FIG. 305.—FINGERS INSERTED, ELBOW BENE, TO ALLOW FINGER-TIPS TO POINT TOWARD UMBILICS.

to the canal, after which the labia are allowed to come together on the examining fingers (Fig. 304). Great care is to be employed to avoid the anal region, the fingers coming in contact only with the mucous membrane of the introitus vaginae, and the side of the two sterile fingers spreading the labia. These fine details are given because of the importance, as regards the dangers of infection, of the internal examination, and it being so difficult to avoid carrying bacteria from the surface into the vagina and uterus.

Each and every examination is to be conducted with the same care. Six points are to be determined during vaginal exploration, and the laws of asepsis demand that they be made in a certain order:

1. *The Degree of Effacement and Dilatation of the Cervix.*—The fingers pass quickly to the cervix, noting its consistence and size, whether the external os is open, the cervical canal shortened or effaced. The varying degrees of effacement and dilatation have been described and illustrated on pp. 123-127. One will speak of the cervix being effaced and the os admitting three or four fingers, or as being the

the first time high up, the second over the os; and there may be two bags, as in twins, or there may be an accumulation of liquid between the amnion and chorion.

3. *The Diagnosis of Presentation and Position.*—If the external and rectal examinations have been thorough, little more is to be learned from the vaginal, except to confirm or correct. (The findings on internal examination have been described on p. 198, to which the reader is referred.) It is usually impossible to outline the sutures and fontanels through the cervical wall, but the membranes do not hinder it except during the pains. After deciding that the hard, roundish body is the head, and the occipital part—not the face or brow—the finger seeks the sagittal suture. If it is near the promontory, the head is in Naegele's obliquity, or anterior asymmetry; if near the pubis, in posterior asymmetry; if median, it is synclitic. Following the suture, the fontanels are felt—the lozenge-shaped one is the largest, and has four sutures running to it; the Y-shaped one is the smallest, having only three sutures running to it. The angle of the Y points to the face; the obtuse angle of the lozenge points back toward the occiput. (See Figs. 191 and 192.)

The lateral fontanels may impose as the large or small, but one always finds the other close by, and the zygomatic process with the edge of the orbit. A false fontanel will confuse the diagnosis, and its presence should always be suspected when the findings are not typical. To distinguish the sagittal suture from the lambdoid or coronary, it is to be noted that the latter two lie in strongly curved planes, the sagittal lying in a less arched surface. Certainty in defining the position of the head can almost always be obtained by these means, but in cases of doubt it is well to search for the ear. The position of the ear will disclose the position of the head. In the second stage, after hard labor-pains have molded the head and developed on a caput succedaneum, the landmarks are obscured, but still discoverable; and there also recourse may be had to the ear. The tragus points to the face.

4. *The Advancement of the Head Along the Birth-canal.*—By means of external and rectal examination this point can always be determined and a vaginal would not be needed if this were all we wished to learn.

The head is "floating" when it is freely movable above the inlet. It is "fixed at the inlet" when moderate pressure will not dislodge it, but its parietal bosses have not yet passed the region of the inlet.

The head is "engaged" when its greatest transverse plane has passed the region of the inlet. In occipital presentation this is the biparietal plane, and "engagement" is shown clinically, first, by the lowest part of the head having reached the interspinous line or passed it; second, by the covering of the sacrum, two-thirds; third, by the covering of the symphysis, three-fourths, by the advancing head. The head is in the "midplane" when the lowest part of the vault lies between the tuberosities, and "at the pelvic outlet" when the two parietal bosses are passing the tuberosities. After this the head comes well down "on the perineum" and lies in the distended vagina and vulva. By first touching the top of the head and then carrying the fingers to the bony wall of the pelvis, it is easy to determine the relation of one to the other, especially if the maneuver is combined with external palpation. Too great emphasis cannot be laid on the importance of accurately defining the location or "station" of the head in the birth-canal. Before operating this information is absolutely essential. (See p. 727.)

5. *Abnormalities.*—The finger now notes any abnormality, the presence of the cord or fetal parts in the vagina, tumors, excessive rigidity of the perineum, etc.—points which will be touched upon later.

6. *Internal Pelvimetry and Diagnosis of Spacial Relations.*—Unless the pelvis has been carefully measured before, it is done now, or a previous examination supplemented. Running the fingers slowly over the bony walls, the general size of the cavity is appreciated, the size and sharpness of the ischiatic spines determined, the sacrum and posterior wall of the pubis and as much as possible of the linea

terminalis are palpated; then the relations of the head to the pelvis, as described on pp. 727, 728, are elicited and, finally, the fingers take the conjugata diagonalis, the head is not too low. (See p. 246, Fig. 271.)

In the first examination all these six points are to be decided, and in the order named. By going slowly and gently the patient is not hurt, and all the required information will be gained. During a labor pain one must be careful not to rupture the membranes, but it is justifiable to pass the finger-tip lightly around the os to see how much it opens during a contraction, how well the bag of waters forms, and how tense the membrane becomes, thus forming some idea of the strength of the pains. After this the fingers rest at the side of the pelvis until the pain has passed away.

The accoucheur now fills out his history sheet or card.

For his first 200 cases the young practitioner would do well to use a full story sheet, as this practice will best develop his technic and habits of carelessness and accuracy. Later, when he has become busy, he may use the cards illustrated here (Figs. 307 and 308), reserving the extensive history sheet for special or pathologic cases.

The author wishes to emphasize the value of the rectal examination, and its superior guarantee, over the vaginal, in regard to safety from infection. Ninety per cent. of labors can be conducted without the latter, by abdominal and rectal exploration. Where the rectal touch gives doubtful information, a condition which is rapidly overcome by practice, if the fetal heart is unaccountably irregular and in operative cases, it is necessary to invade the vagina.

*The Prognosis of the Mechanism of Labor.*—After all the above information is obtained the various points are weighed and considered. The size and hardness of the child are balanced against the size of the pelvis, and both compared with the labor pains—i. e., the power of the engine is compared with the work it has to do. An opinion is hazarded as to the probable mechanism, and possible abnormalities of the same studied in all their bearings.

The anxious patient will now put two questions to the accoucheur. One, "Is everything right?" should always be answered in the affirmative, with a word of encouragement. In the presence of an anomaly, the husband or near relative must be informed, for the doctor's own protection, but the parturient should be spared the alarm until it is needful to interfere, when the conditions are to be gently, kindly, and with great tact explained to her.

The second query, "How long will it last?" should be answered with consummate care. If a certain hour for the delivery of the child is stated, the clock will very often contradict the statement, and the parturient will lose faith and courage. The writer usually replies that the length of the labor will depend on the strength and frequency of the pains, but that everything is in such good order that it matters little whether the labor lasts a little longer or shorter time.

*The Attendance of the Physician.*—Ideally, every labor case should be continuously attended by a physician from beginning to end. The author enjoys this privilege, having the interne to watch his hospital cases and a private assistant to stay with the parturient, in his home practice. How great the advantages of such plan are and how comforting the practice is cannot be told. It undoubtedly saves the lives of many mothers and children and it certainly prolongs the life and usefulness of the author. If the accoucheur must leave the house, he does so only after assuring himself that the presentation and position of the fetus are good, that the pelvis and child are normal, that the cervix is dilating naturally, that the other is not threatened with eclampsia, that abruptio placentæ and placenta prævia do not exist, and that the infant is in perfect condition. The nurse is to be instructed to listen to the child's heart-tones every hour, and to report at once any unusual happening. Only accurate observation of many labors will give the accoucheur that knowledge which will enable him to determine if it is safe for him

to leave the parturient,—and when, and for how long,—and even with such knowledge he will occasionally return to find the child delivered, the pains having suddenly become very strong. In a primipara it is best to remain in the house after the cervix admits three fingers; certainly with a multipara; and, also, if the pains are very strong and progress rapid, or if the woman's previous labors have been quick.

When the physician does leave the case, he must not visit infectious diseases or touch pus while absent. It is the physician's duty, in the absence of a trained nurse, to provide sufficient sterile water, towels, sheets, etc., as well as to have in readiness the materials for an aseptic reception of the infant.

## CHAPTER XXI

### THE TREATMENT OF THE FIRST AND SECOND STAGES

*Management of the first stage* is one of *watchful expectancy*. The duty of the physician is to observe the efforts of nature, not to aid, until she has proven herself unable to perform the task. Only when nature fails, is art to enter. Nothing is so reprehensible as meddling midwifery. It has cost thousands of valuable lives. To hasten the dilatation of the cervix, either manually, by bags, or by the woman bearing down, may not be made. Premature bearing-down efforts render aid very little in the first stage, and tire her so that she has no strength for the expulsive work of the second stage; further, it is distinctly harmful, and is forced down before the os is dilated, overstretching the broad ligaments, laying the foundation for a future prolapsus uteri. Let the parturient be in a cool room, the admission of dust into the vagina being guarded against by a sterile pad and a T-binder. She may rest at intervals in a rocking chair, or lie on her back or on the side to which the occiput is directed,—usually on her left side. This is to favor rotation. Frequent external examinations may be made to discover the progress of labor, and the uterine tones should be listened to at least every half-hour. If this were more generally practised, intra-uterine asphyxia would be more often discovered early and children saved by rapid delivery. Eclampsia, abruptio placentæ, rupture of the uterus, and the general condition of the mother must also be in the mind of the accoucheur, the possibility of the former, and the changes in the latter, constantly subject for thoughtful consideration. Temperature, pulse, and respiration should be taken and recorded every four hours. If labor is prolonged, the accoucheur should try to procure some sleep for the parturient. Early in the first stage morphin and scopolamin may be given, but not near or during the second stage.

During the labor the woman will refuse nourishment, but she should be allowed to take liquids in order to preserve her strength for the final ordeal of the third stage. This is imperative where the labor promises to be prolonged, as postpartum hemorrhage is more formidable in a weakened patient. Nausea and vomiting are occasionally troublesome and medicines have little effect.

**Bowels.**—Every twelve hours the lower bowel should be evacuated by a small enema, but no enema should be given if the delivery seems very near, on account of the danger of a flood of liquid feces accompanying the birth of the infant. If feces accumulate in the rectum, obstructing delivery, an enema of one ounce of water, two of glycerin, and three of water may be given. During labor the physician and nurse take precautions against contaminating the vulva with discharges.

**Bladder.** The bladder should be emptied regularly every four hours, aided, if need be, by catheter. If filled, it forms an obstacle to delivery, delays rotation, and is liable to incarceration of the placenta and postpartum hemorrhage (Fig. 1).

**Capture of the Bag of Waters.**—When the accoucheur judges this is the time, the patient is put to bed, lying on her back. After it has occurred, a vaginal examination is to be made to discover the size of the cervical opening and a



possible prolapse of the cord. One can also learn if the head is ready to be delivered in which event everything is prepared for this purpose. If labor is delayed long after the dilatation of the cervix, another rectal examination is made to discover the cause, and if the membranes have not ruptured, seeming to be an obstruction to labor, they may be opened vaginally, after proper aseptic preparation. Multiparae often have very rapid deliveries after the membranes break, wherefore it is advisable to begin the sterilization of the hands and the general preparation for the delivery earlier than in primiparous labors.

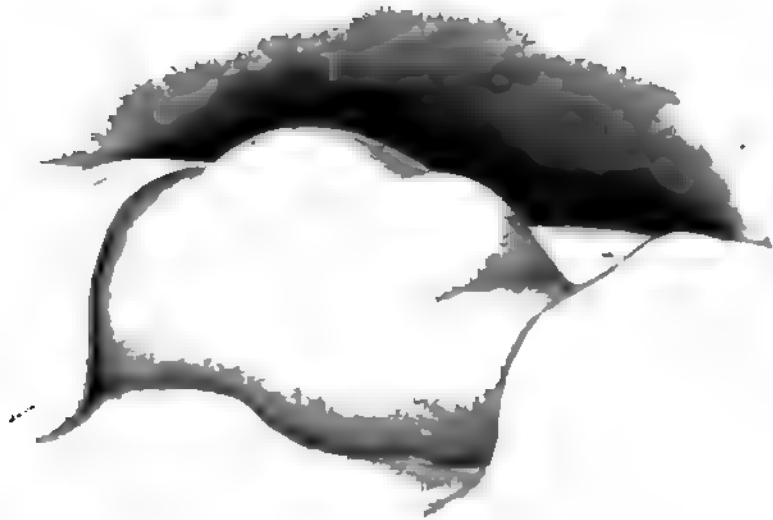


FIG. 309.—THE FULL BLADDER DURING LABOR.  
From a photograph by Bar.

#### CONDUCT OF THE SECOND STAGE

Bearing-down pains do not always indicate that the second stage is begun, nor does the rupture of the bag of waters. The latter may occur before the pains start and, again, not even until after the head is visible. An experienced attendant, from the actions of the parturient, may usually decide that the cervix is fully dilated. A few particularly sharp pains, attended by a show of bright blood, usually indicate that the head is slipping through the cervix. The bed is prepared for delivery by being dressed with sterile sheets, the patient has a pair of sterile leggings or hose and a sterile night-gown put on; the table carrying the solution basins, sterile towels, sterile tape, and scissors for cord is drawn near to the bed, and the operator prepares his hands and puts on head-piece, mouth cover, and the sterile gown and gloves.

The patient often feels as if the bowels are to move, but she may not go to the closet; the movement, if any, being made on a sterile bed-pan. More often the sensation is due to pressure of the head against the rectum. Fecal particles that escape during the pressing efforts must be carefully gathered in sponges wrung out of 1:1500 bichlorid, and the anal region disinfected with the same solution. The bladder is emptied by catheter if necessary.

Four main points are to be considered during this stage: 1. Asepsis and antisepsis. 2. Anesthesia. 3. Protection of the life of the child. 4. Preservation of

perineum. Complications, as *abruptio placentæ*, *eclampsia*, *ruptura uteri*, will be treated under their respective headings.

**Asepsis and antisepsis** have been considered already, and will be touched upon nearly every phase of the treatment here laid down.

**Anesthesia.**—After much experience, the author has come to believe that, generally speaking, it would be better if women could dispense with narcotics during labor, and certainly during the first stage. But it is our duty to relieve pain, and in many cases one will feel it needful to give morphin, chloral, or nitrous oxide and oxygen to reduce the sufferings of a prolonged first stage. A cheerful, confident demeanor, sympathy and encouragement from the physician, will usually prompt the woman to bear the pangs of labor until the second stage is about to begin. Suggestion, to a certain extent, may be employed. When the head is passing through the cervix the pain is intense, and here a few whiffs of ether are very helpful. During the second stage the author gives ether to the "obstetric degree," and as the head escapes from the vulva, the period of greatest anguish, the anesthetic is pushed to the "surgical degree," but stopped as soon as the head is born, the patient usually coming up a few moments after the child makes its first cry.

Women vary very much in their ability to stand pain and in their demands for anesthetics. The author conducts some labors without any narcotic, many with just a few deep inhalations of ether as the head is born, and only a few with anesthesia lasting more than an hour—of course, intermittently. Operative deliveries, with rare exceptions, are done under surgical anesthesia, but cleaning out of the uterus and tamponade are as often done without, as with, narcosis.

Two degrees of anesthesia have been mentioned. Obstetric anesthesia is the use of the narcotic only to dull or relieve the pain, without, or with only a very slight, loss of consciousness. Surgical anesthesia is the abolition of consciousness and of body rigidity.

**Objections to Anesthetics—Chloroform and Ether.**—1. Without doubt the parturient enjoys a slight immunity from the risks of surgical anesthesia, and obstetric anesthesia is but little dangerous. It is not true that deaths have not occurred during the latter form of administration, but they are rare, and other conditions have usually been present, as goiter and status lymphaticus. Diseases of the liver and toxemia, especially of the hepatic type, contraindicate all anesthetics. Chloroform is especially harmful in such cases, not seldom leading to acute yellow atrophy of the liver, a condition which closely resembles, if it is not identical with, "second-day chloroform death."

2. Anesthetics weaken the uterine contractions. The clinician does not need a proof brought from the laboratory. Even under the obstetric degree the pains are sometimes weakened, are further apart, and, in the writer's experience, hemorrhage in the third stage is more profuse, and contraction and retraction of the uterine muscle often delayed or insufficient. Ether acts thus to a much less degree. On the other hand, when contractions are tumultuous or irregular and too acutely painful, or when the woman will not bear down in the second stage because of the pain in the vulva, an anesthetic will often calm and soothe, thereby actually hastening delivery.

3. The anesthetic may affect the child. Administered for a long time, as was formerly the custom, the fetus could obtain sufficient of the drug to be seriously affected by it, investigation having shown that there is an acute albuminoid degeneration of its vital organs during the first days; but given as here recommended, the danger to the child is very slight. Morphin given near the end of labor has led many children.

4. Objections on the score of religious scruples, that pain in labor is "physio-

as led to the careless use of the drug, with many resulting deaths. If the reports of deaths and collapse during anesthesia in midwifery practice continue to come at the same rate as for the last three years, it will soon be necessary to deny that the parturient enjoys any immunities from the dangers of narcosis. Ether is said to reduce the phagocytic power of the blood by its fat-solvent properties, and the introduction of fat could perhaps restore this power.

**Nitrous Oxid and Oxygen.**—In 1800 Sir Humphrey Davy recommended  $\text{N}_2\text{O}$  for surgical operations not attended with much hemorrhage. In 1868 Edmund Andrews of Chicago suggested that oxygen be given with it. In 1880 Klikowitch of St. Petersburg recommended an 80 and 20 per cent. mixture for obstetric cases, and in 1881 v. Winckel reported favorable results in 50 deliveries. When  $\text{N}_2\text{O}$  and oxygen came to more general employment by surgeons and dentists, obstetricians used it more frequently in their work, and, among others, the author used it for cleaning out abortions, cesarean section, insertion of colpeurynters, etc. Guedel of Indianapolis in 1911, Lynch and Hoag in 1913 used this form of analgesia in normal labor, and now it is generally employed all over the United States.

While not sharing the enthusiasm of Lynch, Davis, and others for this form of analgesia, the author uses it very frequently and recommends it for suitable cases. It may be given earlier than ether or chloroform, near the end of the first stage, and throughout the second. If the first stage prolonged morphin is preferred, with bromids per rectum, or scopolamin. There are no contraindications to its use. It is safer than chloroform in all forms of liver, heart, and kidney disease, and, unless an operation requiring complete relaxation and a not overbloody field, is to be done, it is more desirable than ether. In heart disease I prefer ether, unless the operation can be done under local anesthesia, with a few breaths of ether occasionally to help over the most painful parts. In toxemic conditions, for short, bloodless operations, like curetage, application of colpeurynters, minor perineorrhaphies, we use gas or, preferably, local anesthesia, with gas to assist. In major operations local anesthesia where possible, otherwise ether. The prolonged use of anesthesia with gas is not safer than ether. For version, forceps, extensive perineorrhaphy, vaginal cesarean section ether is the agent of choice. Abdominal sections are being done more and more with local anesthesia, and in many cases the patients declare—what is evident to the observer—that they suffered much less pain than in a natural delivery.

**Method of Administration.**—For surgical or deep narcosis the method of giving  $\text{N}_2\text{O}$  and oxygen does not differ from that employed by surgeons, and the reader is referred to appropriate text-books.

For obstetric analgesia it is desirable but not absolutely necessary to have a machine which enables us to administer percentages of the two gases. But a skillful operator (and this form of analgesia requires most minute attention to detail as well as skill) can get good results with a simple apparatus.

When the pains are regular and very strong,—in my cases I prefer to wait until the cervix is fully three-fourths dilated,—the gas is started. The large inhaler is used, and at the very beginning of the pain, perceived by the hand laid on the belly, or felt by the patient, two deep breaths of pure  $\text{N}_2\text{O}$  are allowed, the next two inhalations are of a mixture of 90 per cent.  $\text{N}_2\text{O}$  and 10 per cent. oxygen, the next two of 50 and 50, then pure oxygen for three breaths,—inhaler removed. At the proper time the parturient may be allowed to bear down and labor is conducted in the usual manner.

The patient must not become cyanotic, must not lose consciousness, must not complain of headache,—which mean that too much  $\text{N}_2\text{O}$  has been given. Thirst is often marked,—water should be allowed freely. The amount of  $\text{N}_2\text{O}$  needed varies with every patient, and this must be determined with care. The gas is given only during the pains, but more must be given as the second stage nears its end, and during the actual birth of the head deep anesthesia is produced for a few minutes. When the child is delivered the  $\text{N}_2\text{O}$  is turned off and pure oxygen given to prevent cyanosis in the baby, but how effectual this is cannot be proved scientifically. Occasionally it is necessary to change to ether for the actual delivery. Cases are recorded where this intermittent administration of the gases was kept up for ten and twelve hours, but the author is certain this is dangerous because of degeneration of the liver, maternal as well as fetal. In one case the author used gas for five hours and the patient suffered marked hemolysis, and nearly died from postpartum hemorrhage. Two to three hours are the usual requirements, but one should not continue over four hours. Contrary to experience with chloroform and ether, the uterine contractions are not weakened by gas, indeed, labor is shortened, the pains seem more effectual. Delivery may be very rapid and the patient make little or no outcry. Lacerations are not less frequent than with other narcotics. The puerperium is not affected, the child thrives as usual. Rejections to the use of  $\text{N}_2\text{O}$  and oxygen on the ground of expense and cumbrousness must be removed by technic.

**History.**—Narcotic potions were administered by the ancients in labor. Theocritus mentions them as given to Antigone. Other examples are cited by Simpson. Sir James Y. Simpson

was the first to use ether in obstetric practice on January 19, 1847, when he did a version and an extraction. In November of the same year he discovered the anesthetic properties of chloroform, and used it in labor cases to the exclusion of ether, and widely advocated the practice. A storm of adverse criticism against both anesthetics broke loose at home and abroad, and, to our minds, a curious and ridiculous polemic was waged between Simpson and his opponents. (See *Obstetric Memoirs*, Simpson, vol. ii, *Anesthetics*.) N. C. Keep, of Boston, was the first, according to Channing, to use ether in labor in America—April 7, 1847. The use of an anesthetic in labor spread quickly, particularly after Victoria, Queen of England, in 1853 and 1857 had enjoyed its benefits. It was called the Queen's chloroform, or *anesthesia à la reine*.

**Other Anesthetics.**—Cocainization of the spinal cord, invented by Corning and elaborated by Bier and Tuffier, has recently been gaining vogue. Its dangers—respiratory paralysis, headache, vomiting, hyperpyrexia, tachycardia, muscular spasms, drug intoxication, meningitis, and peripheral necroses—are being gradually eliminated by improvement in the technic. Novocain and stovain are now used. Wayne Babcock, of Philadelphia, reports 2000 surgical cases with no deaths directly ascribable to the method, but Krönig says spinal anesthesia is dangerous in pregnancy and labor. Recently Stoeckel advised the injection of the cocain into the sacral canal, and Sellheim, cocainization of the pudic nerves, reaching them through vaginal puncture. Local anesthetics have been employed, as cocain and belladonna, to the cervix, the perineum, and the rectum.

Novocain is a very valuable local anesthetic, and the author uses it for minor surface operations and also for cesarean section when there are contraindications for the use of a general anesthetic, such as eclampsia, heart disease, bronchitis, pneumonia. To each ounce of  $\frac{1}{2}$  per cent. novocain solution 3 drops of 1 : 1000 adrenalin are added. Three ounces of this solution may be used with safety, but so much is seldom required. Local anesthesia should be used—much more extensively than it is at present.

Hypnotism has been used in hysteric subjects with reported good effects. Apollo was born of Latona under such influence. The writer frequently uses suggestion during labor to aid the parturient to bear the pain, and after labor gentle suggestion will aid in obtaining the quiet and restful sleep so conducive to rapid restoration of the patient's nerve equilibrium.

**Scopolamin-morphin Amnesia (Twilight Sleep).**—Recently, as the result of articles which appeared in several popular magazines describing the "Twilight Sleep" as practised in the Krönig clinic in Freiburg, considerable interest has been aroused, and the American profession has been induced to again try a remedy which was tried twelve years ago and found wanting. Schneiderlin, a neurologist, in 1899, recommended the employment of morphin combined with scopolamin for the production of surgical anesthesia. v. Steinbüchel in 1902 first recommended its use in labor. Naturally, the profession eagerly grasped this opportunity to relieve women of the pain of childbirth, and the drugs soon were extensively employed, here and abroad. Reports were made by Greene, Newell, Halpenny and Vrooman, Krönig and Gauss, Leopold, Avarffy, Sir J. H. Croom, Flatau, Kleinertz, Steffens, Hocheisen, Veit, Lequeux, Hatcher, and others at intervals during the last twelve years. Some praised the remedy, some condemned it, some were lukewarm, but all save Krönig and Gauss practically abandoned it. My own experience at the time was small but unfavorable, and I, too, quickly abandoned the method.

In November, 1913, Krönig again called the attention of the profession to this matter in a paper read in Chicago, and claimed good results in 3000 cases. At this time I was in Freiburg and studied the method as practised there. It was at least unfortunate that the 10 cases I observed showed very bad results, confirming my own previous experiences with the drugs and those reported by others, which were as follows: Asphyxia and narcosis of the children; prolongation of labor, hours often and days sometimes; arrest of rotation of the head, the three conditions necessitating a more frequent resort to forceps; restless delirium, even violence, disturbances of heart and lungs; difficulty in preserving the asepsis of the delivery; postpartum hemorrhage, and uncertain results. In the clinics of Heidelberg, Berlin, Dresden, Munich, and Vienna the Freiburg method has been tried and discarded.

However, as the result of the magazine and newspaper publicity, the profession is giving the "Twilight Sleep" another trial, striving to avoid the bad effects by reducing the dosage and selecting the cases, following the experience of the Freiburg clinic. Harrar and McPherson, Rongy, Williams (1917), Cary, Polak, and the author have now had considerable experience, and the following conclusions may be made: (1) The drugs may not be used to produce anesthesia or insensibility to pain, only amnesia, forgetfulness or, rather, lack of appreciation of pain and slight analgesia. (2) The method is not adapted for general usage in the home, only in maternities with a sufficient and efficient staff of physicians and nurses. (3) The fetal heart-tones must be noted every five to ten minutes, at the end of the second stage every two minutes, likewise the condition of the mother, and a capable accoucheur must be at hand to interfere at once if need be. (4) While the life dangers to the mother can be eliminated, the patient must be willing to pay the price of possible lacerations and hemorrhage, and an occasional loss or injury of the child as the cost of her relief from suffering.

The Freiburg method is as follows: After labor is well on its way, when the pains are four or five minutes apart and lasting thirty or more seconds, the first injection is made. This consists of  $\frac{1}{4}$  grain of morphin and  $\frac{1}{16}$  grain scopolamin. Krönig and Gauss insist on the use of narcophin—a proprietary narcotin-morphin-meconate, and Straub's "Scopolamin Haltbar." The latter is a permanent solution of this delicate drug, purchasable in sterile ampules. Forty-five minutes after the first injection another is given, but only  $\frac{1}{32}$  of scopolamin is used. After this the hypodermics are given every hour, using  $\frac{1}{32}$  to  $\frac{1}{16}$  of scopolamin, and, in prolonged labors, an occa-

dose of morphin,  $\frac{1}{2}$  grain—all depending on the individual case. The object is to maintain patient in a state of amnesia, and this is determined by testing her memory. The room must be fully darkened, only the patient's face should be well shaded. Quiet must be kept, only necessary attentions permitted. Shortly after the second injection, the patient if she remembers what has gone before, has she seen the nurse or intern? If she remembers, a dose is given. If not, nothing is done for an hour, when if the mind seems to be clearer, scopolamin is given. Care must be exercised that the woman does not attain full consciousness. Usually, after one and one-half hours she drops off to slumber, the face reddened, mouth dry, the pupils contracted, the conjunctivæ congested, the pulse 90 to 120, the skin warm and dry. Food is not given, but water freely; the patient asks for attention to her wants, the pains she moves about restlessly, or turns from one side to the other, or grunts a little, occasionally opens her eyes—to drop off to sleep again when the pain passes. She will answer to questions, but incoherently, and often forgets to finish a sentence begun, dropping off to sleep. As the second stage draws near its end she bears down and becomes very restless. Finally this becomes extreme, and several nurses are required to hold her to prevent too much strain of the head, also to prevent her from clutching the pudenda with her hands. Her abdominal jactitation also disturbs the asepsis. A few whiffs of ether are often needed as the head passes through the vulva.

An acute observer will always know when the head has reached the perineum, though requires greater watchfulness than usual. Throughout the labor, but especially in the second stage, fetal heart-tones must be auscultated. I have found they often fluctuate decidedly, falling from 100 to 180, but there is little cause for alarm unless they remain below or above these figures. In the second stage the irregular and slow or fast heart-beat is very much more ominous and often indicates forceps. The passing of meconium is still more ominous. After the child usually cries vigorously at once, but may be born in a state of apnea as one in Cesarean sections. Mild means of resuscitation suffice, but the child may be asphyxiated to a serious degree, requiring prolonged efforts to start respiration. Williams had a case of six-hour narcosis.

Labor in most cases is slightly prolonged, in some cases much delayed. If this occurs in the second stage, hypophysin may be administered or the forceps applied. Polak uses the forceps, usually after a second stage delay of an hour in multiparæ and two hours in primiparæ. For the delivery and for sutures ether is necessary, as the patient struggles and is not responsive to narcotics. It may be even necessary to give ether for a thorough inspection of the perineum for lacerations. If too much pain is perceived at the end of labor the effect of the treatment may be temporary returning.

Postpartum hemorrhage is not more frequent after spontaneous labors, but it is almost the rule after operative deliveries. It responds readily to the usual treatment. I usually tampon the bleeding ceases very quickly.

The woman wakes up from an hour to six after the birth, and has none or faint recollections of parturition. She often asks what day it is. If, however, she bends her mind to it she will remember more and more of the labor. It is best to keep up the amnesic effect by suggestion, with which much can be accomplished. Women that were noisy and intractable while under the influence of the drugs may remember nothing, while those that were quiet and apparently unconscious may remember nearly everything. The puerperium does not differ much from the usual, if the local injury has been slight there is but little soreness; in operative and hemorrhage cases the condition of the patient is as would be expected. For more details see *Obstetrics for Nurses*, DeLee, 1917.

**Contra-indications.**—Contracted pelvis of all types; inertia uteri from any cause; advanced cardiac and heart disease; where there exists an immediate or prospective indication for the early termination of labor, as placenta prævia, eclampsia, asphyxia in utero; where there is an idiosyncrasy to atropin, or the first dose shows this; advanced labor (the best time is to operate from eight to four hours before actual delivery). A certain number of women will prove refractory and it would require too much of both drugs to produce amnesia. Again, the drugs stop labor completely and must be discontinued on this account. In only a small percentage, or 30, of cases may we use the treatment, which is also Harrar's opinion.

In general, it may be said that the scopolamin-morphin method requires a high degree of technical skill aside from the ability to properly observe and conduct the seminarcosis. It demands the constant attendance or, at least, proximity of the accoucheur, and, if it is to be administered properly, a well-equipped maternity hospital. I am convinced that its generalized employment will result in a repetition of the fetal and maternal mortalities and morbidity of twelve years ago.

Since the above was written three years have elapsed and experience has proved the soundness of the conclusions. In America "twilight sleep" is being used as a routine in only a few hospitals. Several have declared against it in the public prints. As late as 1917 it enjoys no vogue in Germany. Many accoucheurs use an occasional dose of scopolamin and morphin in the second stage, especially if it is prolonged,—the author does also,—as he has been doing for years, and it is to be cordially regretted, "twilight sleep" has, for the third time, failed to meet the demands of safety.

**Morphin and Chloral.**—Morphin is frequently used during the first stage of labor, alone or combined with a minute dose of atropin or scopolamin, to calm excessive uterine action, to soothe the patient, or to procure needed rest. For the latter purpose it may be supplemented with a solution of soda per rectum. Morphin should not be given toward the end of the first stage nor in the second stage, because experience has shown that the fetus is then more likely to be nar-

cotized and rendered incapable of establishing respiration after delivery. Chloral should be very sparingly used, its action being very similar to that of chloroform, and, too, it irritates the kidneys.

**Preservation of the Life of the Fetus.**—An effort should be made to reduce the infant mortality during child-birth. The author is convinced that attention to the child during the second stage of ordinary labor will result in a greater total saving of life than the application of all the newer methods of operative delivery—vaginal cesarean section, hebstectomy, and the extension of the indications for cesarean section in contracted pelvis. All honor to these efforts! but a greater and richer field lies close at hand in the practice of every obstetric attendant. A continual watch for the first signs of asphyxia of the unborn child, and for the symptoms of abruption of the placenta in the second stage, will not seldom be rewarded by their discovery, and an immediate delivery will save the life of the fetus.

For the purpose of frequently auscultating the fetal heart, during the second stage, the patient is allowed to lie on her back until the perineum is well distended, and then turned on her side only for the delivery, if the accoucheur prefers delivery



FIG. 309a.—THE OBSTETRIC STETHOSCOPE.

in this position. The author delivers most women on the back, in order to be able to hear the fetal heart more satisfactorily. To make the auscultation of the fetal heart easy after the accoucheur has donned sterile clothing the author recommends the head stethoscope shown in Fig. 309a. One should listen to the fetal heart every minute or two during the second stage.

**Preservation of the Perineum.**—Anatomic study of the pelvic floor after delivery always shows evidences of injury to all its structures. The connective tissue is torn in many places, the layers of fascia are loosened, the levator ani muscle lacerated more or less; the urogenital septum is always ruptured, the perineal body frequently, and all the tissues are bruised, showing larger or smaller

morrhages and suggillations. The later results of these macroscopic and microscopic injuries are shrinking and atrophy of the pelvic diaphragm, relaxation of me, prolapse of the urethra, vagina, bladder, uterus—all depending on the extent the traumatism. In importance these lacerations vary very much. Worst their effects are the tears of the levator ani, the perineal ones being less harmful, and yet it is the prevention of perineal lacerations that occupies so much of the coucheur's attention. Our best efforts are to be directed to preserve the levator ani, but some attention should be given to the perineum itself, because it has physiologic and pathologic dignity; extensive rupture of this body may cause erythema, vaginitis, cervicitis, endometritis from infection ascending through the uterine introitus; a perineal tear once started may go through the anus into the rectum, causing that great affliction—fecal incontinence; fresh tears may form the basis of bacterial invasion; the structures once torn can never be perfectly restored; usually, the injury may often be prevented, and, if not entirely, it may be limited to a safe degree. The author has found the hymen tears in all cases; 60 per cent. of primiparæ have tears of the fourchet—the so-called first-degree laceration; 25 per cent. of primiparæ and 10 per cent. of multiparæ have lacerations extending all into the perineal body, and in 10 per cent. the injury exposes the sphincter ani—the so-called second degree. Only in operative cases has a complete laceration—that is, through the sphincter ani—occurred. These percentages are larger than those given in most text-books, the reason being that the author, after the levator ani is well stretched, allows the head to issue rapidly, with a view to sparing the child's brain the traumatism of a prolonged perineal "protection." Without doubt children suffer brain injuries because of the accoucheur's anxiety to avoid perineal lacerations. The excessively slow delivery, too, has been responsible for cases of still-birth from asphyxia.

*Causation.*—Rupture of the perineum may not always be prevented, even in the best hands and under the most favorable conditions. The pelvic outlet may be diseased, as by edema, excessive deposition of fat, a white-cell infiltration from syphilis, condylomata lata and acuminata, varicosities, or through lack of elasticity from scars, from previous operation, age, or constitution. In some women otherwise well the perineum tears like wet blotting-paper. A narrow pubic arch, by forcing the head back into the perineum and not allowing the occiput to crowd up close to the ligamentum arcuatum, favors rupture. A vulva situated high on the pubis is subject to injury. Necessity for rapid delivery often makes us disregard the perineum, as in breech cases and when the child is threatened with asphyxia. Delivery effected early in labor finds the perineum unprepared for the rapid dilatation. Exit of the head in unfavorable attitudes—face, brow, forehead, and in posterior rotation of the occiput—frequently causes lacerations, because the most favorable circumferences are not presented to the canal. A large child acts in the same way by overstretching the outlet.

*Treatment.*—Prevention of perineal lacerations naturally will proceed along lines indicated above. Here only those precautions needful in spontaneous labor will be described. How to care for the levator ani and perineum during forceps and other operative deliveries will be given in full in the proper chapters.

The levator ani and the fascia above and below it, making up the pelvic diaphragm, can be spared serious injury only by slow dilatation. While carefully watching the fetal heart-tones, the patient is not allowed to bear down overmuch during the first part of the second stage. The author does not hurry this period of labor without indication. If the pains and the bearing-down efforts are tumultuous, the woman is laid on her side and ether given as a moderator. While more frequent in operative deliveries, the tear in the levator sometimes occurs at the point of its attachment to the pubic rami, under the arch of the pubis. This accident may rarely

be recognized before it has occurred, but if it is, one should incise the muscle in the right vaginal sulcus, because the high hidden tear may be impossible to sew up afterward, but the lower incision is accessible to the needle.

The principles of the protection of the perineum are two: (1) Deliver slowly, developing to the ultimate the elasticity of the pelvic floor; (2) deliver the head in forced flexion, to present to the parturient passage the smallest circumferences of the head. The first principle needs no elucidation. A hard body which has to overcome the resistance offered by an elastic cylinder will be less likely to tear the cylinder if forced through it very slowly. A brief study of the mechanism of labor will show the advantages of keeping the head well flexed until the larger part of it



FIG. 310. ARRANGEMENT FOR DELIVERY ON SIDE IN A HOME.

Hot and cold sterile water in pitchers. One basin has  $\text{HgCl}_2$  1:5000, one, 1 $\frac{1}{4}$  per cent. lysol solution. Scissors, cord tape, artery clamp, and catheter lie in a saucer in 1 per cent. lysol solution. A pile of sterile towels and the nurse's hand forceps are on the table. At the extreme left is the warm receiver for the infant. Three table-boards are under the mattress.

has escaped from the vulva. If the head were to come out in partial extension, there would be presented to the girdle of resistance, made up of the pubic arch and the pelvic floor, the occipitobregmatic, occipitofrontal, and occipitomenal diameters and circumferences. If the chin is forced down on the sternum and flexion thus maintained until the nape of the neck comes to fit closely into the pubic arch, the diameters and circumferences which have to pass the ring of the outlet are the suboccipitobregmatic, suboccipitofrontal, and suboccipitomenal, which are less by  $1\frac{1}{2}$  to 3 cm.

**Mode of Procedure.**—The patient may lie either on the side or on the back. It is well for the accoucheur to learn both methods, since each has its advantages, and the principles of the operation, with a little practice, may be practised equally well in either position. Owing to the possibility of better control of the fetal heart-tones the author usually delivers the patient on the back. In out-patient dispensary service, because of the filthy beds which sag in the middle, the poor light, and the general difficulty of maintaining asepsis, the lateral posture is preferred. This posture, too, in inexperienced hands, shows a smaller percentage of lacerations. For purposes of description and illustration delivery on the side will be



considered first. Most patients are allowed to lie on the back until the perineum begins to bulge decidedly. The fetal heart-tones being normal, the woman is then

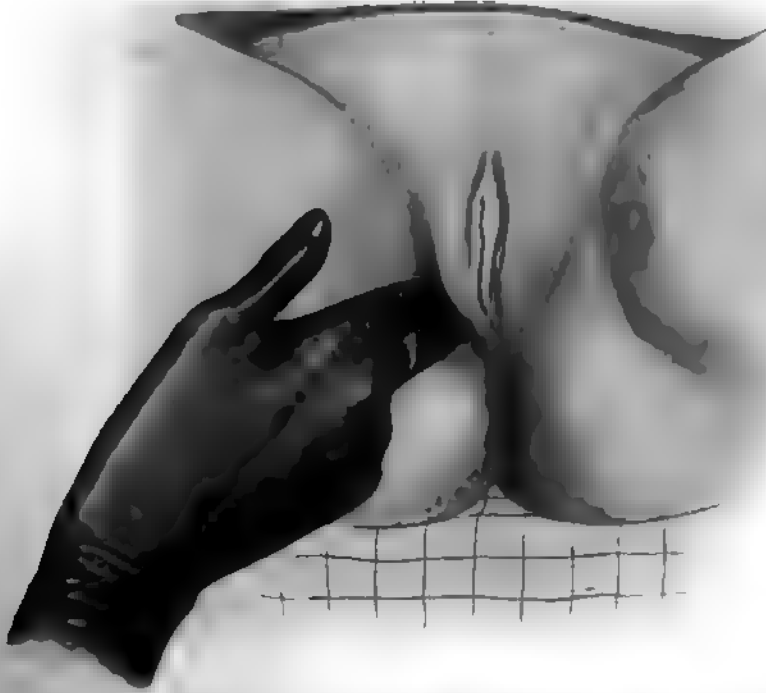


FIG. 311.—DETERMINING THE RATE OF ADVANCE OF THE HEAD BY PRESSING IN THE PERINEUM.



FIG. 312.—DELIVERY ON SIDE. RESTRAINING TOO RAPID DESCENT BY GENTLE PRESSURE.  
The following eight illustrations are from photographs taken at the Chicago Lying-in Hospital.

brought to the edge of the bed, with the buttocks directed toward the best light.



be given. Many an infant has lost its life because the attendant was overanxious to deliver the woman "without stitches." The protracted second stage resulted



FIG. 317.—DELIVERY OF POSTERIOR SHOULDER.

Crowding the child gently upward into the pubic arch, to forestall injury by the broad chest. The elbow of the left arm follows down the receding uterus. The author prefers to turn the patient on her back, as in Fig. 318.



FIG. 318.—THE LEFT HAND NOW GRASPS THE UTERUS, THE RIGHT LAYS THE INFANT IN POSITION.

in its loss by asphyxiation. Again, the infant may be injured by pressing on the head too forcibly, causing skull fracture, and, finally, if the uterine and abdominal

Efforts are violent and the child not allowed to come out, the uterus may rupture, as it does under other circumstances of opposition to its powerful action. The author has seen all these injuries.

Not seldom feces and mucus are forced from the anal opening during the woman's bearing-down efforts. Since there is real danger of infection from this source, the accoucheur must collect such discharges in large cotton sponges soaked in 1:1500 bichlorid, using care not to soil his glove nor the region around the anus. This region, as an additional precaution, is resterilized with both antiseptic solu-



2. 319.—PATIENT ON BACK, WITH ONE FOOT ON BED AND ONE ON A STOOL, FOR THE DELIVERY OF THE SHOULDERS, IF DIFFICULT.

Some accoucheurs prefer to deliver the trunk in this position in every labor.

ones. The author has never seen any harm from the very liberal use of these antiseptics on the vulva and perineum.

In gentle fashion the head is permitted to descend until its greatest periphery rests in the distended vulva. It is now *delivered in the interval between pains*. The head is restrained at the height of the bearing-down effort, the woman is asked to breathe through her mouth or to cry out, while the accoucheur tucks the clitoris and labia minora behind the occiput under the pubis. If the patient, in the desertion of pain, bears down violently, ether is administered. After the pain has

ceased the woman is asked to bear down, and during this effort the distended perineum is slipped back over the forehead and face under the chin. A sterile towel is tucked under the chin and covers the anus, which prevents infection of the accoucheur's hands and of the child's mouth by feces.

During this manœuvre the head is maintained in a state of flexion, *not by pressure on the forehead through the perineum*, but by manipulation of the part that is accessible to the fingers. A gentle attempt to lead the suboccipital region under the pubis is first made by pressing the head back onto the perineum with the finger on the occipital protuberance, during two or three pains. When the head has descended far enough to give hold to the fingers, these applied right at the edge of the frenulum are used to press it up under the arch of the pubis, and, as the head



FIG. 320.—DEPRESSING HEAD FOR DELIVERY OF ANTERIOR SHOULDER.  
Be careful not to overstretch the neck and cause Erb's palsy.

finally rolls up onto the pubis, the flexion is maintained, as far as possible, by making pressure on the part delivered against the bone (Figs. 313 and 316).

As soon as the face is delivered the forehead and eyelids are wiped with a *gauze sponge* wrung dry out of 1:1500 bichlorid solution, the mucus is squeezed out of the nostrils and wiped out of the mouth with the finger, covered, if need be, with a piece of soft linen or lintine. These details are important. Removal of the vaginal secretions from the neighborhood of the eyes is to prevent *ophthalmia neonatorum*; the removal of mucus from the nose and mouth, to prevent aspiration of the foreign matter, with subsequent intestinal sepsis, atelectasis, and bronchopneumonia.

The accoucheur now feels for the cord and notes if it is around the neck, and if

it is tight, making an obstacle to delivery. If it does this, it should be clamped and cut. A cord that is too short, or relatively too short, may, unless cut, pull on the placenta and cause anomalies in the third stage, or even inversion of the uterus. If the patient has been lying on her side, she is now gently turned onto the back for the delivery of the trunk. This procedure brings the upper limb over the edge of the bed, and it may be allowed to rest on a chair, which leaves the patient in the oblique position, with the vulva near the side of the bed, and very favorably placed for delivery of the shoulders (Fig. 319). If preferred, the patient may be moved over to the middle, with both legs resting in the bed, or put across the bed.

*Delivery of the Shoulders.*—A tendency to hurry this part of labor should be resisted. If the child's face is normally blue and reacts to stimuli, *e. g.*, rubbing, one may wait for the renewed action of the uterus. After a minute or two another



FIG. 321.—LIFTING THE HEAD FOR DELIVERY OF POSTERIOR SHOULDER.

pain comes on and the patient gently bears down until the anterior shoulder becomes visible just behind the pubis. Now the accoucheur lifts the child up and brings the posterior shoulder over the perineum. If the child's hand is accessible, the arm is drawn out gently. Then the child is depressed as the anterior shoulder comes from behind the pubis, and now the rest of the body follows in one long pain without particular mechanism. The child must not be dragged out of the uterus. It is best if the natural powers force it out, the physician aiding the process only by directing the mechanism, as above indicated. A perineum may be torn by the shoulders or a slight tear plowed deeply by them, and the clavicles may be broken, or the nerves and muscles of the neck overstretched at this stage of the delivery unless proper care be exercised.

If the delivery of the shoulders is delayed too long, the woman is asked to bear down, failing which the hand on the belly performs Kristeller's expression, or the

child is delivered by slow traction following the mechanism here indicated. (See p. 1015 for pathologic shoulder deliveries.)

**Historic.**—Hippocrates recognized the importance of the prevention of perineal laceration, and sought to soften the structures by oily salves and relaxing douches, a practice which was recommended by Baudelocque and others, even by some today, in the form of hot moist applications. Van Horn (seventeenth century) dilated the perineum, pushing back the coccyx and stretching the levator ani manually, with boring or circular movements, a procedure that was used for many years by most authorities and is still recommended in a modified manner by Edgar for normal cases. The author advises such interference only in pathologic cases, and as a preparation for a rapid breech or forceps extraction. Various instruments were designed to lift the head away from the perineum, one of the most curious being a perineal horn, like one used for putting on shoes.

Soranus of Ephesus (about 110 A. D.) first attempted to "support" the perineum with the hand, a notion that it has been impossible to eradicate from the medical mind. Goodell tried to "relax the perineum" by pressure from the two sides toward the middle line. Various attempts have been made by some accoucheurs to lift the perineum forward with fingers introduced into the anus, or by the hand placed on the perineum from the outside. Others try to strip the vulva back over the head—all manœuvres which fail in their object, are harmful because of injury to the levator ani and rectum, and dangerous because of sepsis. Finally, may be mentioned the employment of incisions in the perineum to avoid deeper tears of the structure.

**Episiotomy.**—When a tear of the perineum appears inevitable, the question arises, shall it be allowed to occur spontaneously and go in whatever direction it may, or shall we seek to anticipate it, or at least divert it away from the sphincter into unimportant structures? Ould, in 1742, cut the vulvar outlet when it offered too great resistance to the escape of the head. G. P. Michaëlis, in 1810, incised the perineum to avoid a dangerous tear. Ritgen and Schultze made numerous small incisions in the tense vulvar ring. Scanzoni recommended two lateral incisions, Credè, one, directed from the frenulum toward the tuberosity. Many accoucheurs perform the operation, preferring a clean cut to the jagged tear, and claiming that the lateral structures are less important than the central portion of the perineum, and fearing that a tear beginning in the middle line only too easily goes beyond control of the attendant into the sphincter ani, even into the rectum. Episiotomy is the name applied to the operation, which might more correctly be considered under the heading of operative obstetrics, but, because of its frequency, will be described here. The incision is made in three ways—the lateral or bilateral (Fig. 322), where the cut is parallel with the long axis of the mother's person; the median, where the line lies in the raphé (a method recently again urged by Küstner) and the mediolateral, recommended by



FIG. 322.—DIAGRAM OF THREE KINDS OF EPISIOTOMY.

1, 1, The bilateral, 2 the median, 3, 3, the mediolateral, recommended by author. A radial incision may be made anywhere between 1 and 2.

Farmer and practised by the author. One must be sure that he understands what is expected of episiotomy. It simply cuts the skin, the urogenital septum, with the constrictor cunni and transversus perinei, and a few of the anterior fibers of the puborectal portion of the levator ani. Dührssen, in 1888, recommended a deeper episiotomy or perineotomy for pathologic cases, in which the incision went through the levator ani into the ischiorectal fossa. There are special indications for this extensive operation, and it is performed only when delivery must be effected before the levator has had time to stretch even a little.

The indications for the usual episiotomy are: Resistant perineum, causing delay in the exit of the head through the vulva; some pathologic condition of the

a, scars, syphilis, etc.; abnormal size of the child or abnormal mechanism, including mechanical disproportion; the necessity for rapid extraction when one



FIG. 323.—THE OPERATION OF EPISIOTOMY.  
If labor is not so far advanced, the incision should be less vertical.

not give the perineum time to dilate, and when one sees that the perineum will tear, to divert the laceration away from the anus.



FIG. 324.—PERINEUM SCISSORS.  
Rounded points do not injure child's scalp, and are safer for rubber gloves.

It is best to wait until the head has stretched the levator ani well (which is aided by the opening of the anus and the dislocation of the anus downward and forward), and only the resistance of the vulvar outlet remains to be overcome.



If at this point, by vaginal inspection or palpation, one discovers the beginning of a tear, it is anticipated by episiotomy. One blade of the scissors is laid on the vaginal mucous membrane, the other rests on the skin of the perineal body, midway between the anus and the tuberosity of the ischium, the cutting angle of the scissors being at the median raphé (Fig. 323). With the finger and thumb of the other hand the sphincter is pressed out of the bite of the scissors. The patient is given a few extra-deep inhalations of ether, and with a single quick motion the tissues are severed. Hemorrhage is stopped by pressure. Usually the head issues quickly after the incision is made, and then the bleeding ceases, but if it does not, a firm tampon will check it until the sutures are applied. If a deep perineotomy is to be made, a systematic operation is performed as in laparotomy, the structures being incised with scissors or a scalpel, one after the other, in anatomical fashion. The incision is repaired after delivery of the placenta, in the manner usual with perineorrhaphies (p. 754).

### THE CARE OF THE CHILD

A warm sterile receiver is ready for the new-born individual, who, as soon as born, is placed near the vulva, so that the cord is not dragged upon, yet far enough away so that he is not soiled with the blood, feces, etc., about the anus, and also safe from compression by the mother's person.

The first attention to the child is the wiping of the face and eyelids with a sponge squeezed dry from a 1:1500 bichlorid solution, and removal of the mucus from the air-passages immediately after the head is born—points already mentioned.

**Tying the Cord.**—After waiting until the pulsation in the exposed umbilical cord has perceptibly weakened or disappeared, the child is severed from its mother. Until the cord is severed the child is still a part of its mother and has no legal existence. With a piece of linen bobbin, coarse silk, rubber band, or any strong string the cord is ligated close to the skin margin of the navel ( $\frac{1}{2}$  inch), first being sure that there is no umbilical hernia which might allow a loop of gut to be caught in the grasp of the ligature. Another ligature is placed a few inches from the first, and, protecting the child from injury, the cord is severed with sterile, dull scissors close to the first ligature. It is important to leave as little as possible of the cord to be cast off, and, further, a short stump is easier to dress and less likely to be dragged upon. The short stump method was practised by Mauriceau and only recently revived. The first tying must be made very secure, and security is obtained by tightening the knot slowly and interruptedly, permitting the jelly of Wharton to escape from under the thread, which thus comes to constrict only the vessels.

During the four or eight minutes while waiting to tie the cord the child obtains from 40 to 60 gm. of the reserve blood of the placenta—a fact which was first shown by Budin. The blood is pressed into the child by the uterine contractions, and part is aspirated by the expanding chest. This extra blood the child needs in its first days of life, and observation has shown that such children lose less in weight and are less subject to disease. It is an error, on the other hand, to force the blood of the placenta into the child by stripping the cord toward the child. This overloads its blood-vessels, causes icterus, melena, even apoplexy. The child never had the extra blood of the placenta. The practice of waiting until the placenta is delivered before tying the cord is not recommended.

A second ligature is applied to the cord to keep the blood in the placenta and give the uterus a firm body to act on, to prevent the soiling of the bed and patient with blood which would flow from the open vessels, and to preserve a possible twin, still in the uterus, from hemorrhage, since the two circulations of twins usually anastomose.

The stump and the region of the belly around it are now wiped with 1:1500 ichlorid or pure alcohol, a piece of dry gauze laid over the wound, and the infant, rapped in a sterile receiver, is handed to the nurse, who puts it in a safe, warm lace, delegating a relative to watch it and see that it breathes naturally.

**The Care of the Eyes.**—Many States have passed legislation making the antiseptic treatment of the eyes of the new-born obligatory on the part of the accoucheur. Statistics prove that about 30 per cent. of the cases of blindness admitted to the institutions supported by the State have lost the light of day through the lack of proper precaution at the time of birth. The blindness is caused by a disease known as ophthalmia neonatorum, which is a purulent inflammation of the conjunctiva and cornea, due, nine times out of ten, to the gonococcus of Neisser. The disease is highly preventable, and, even in eleemosynary lying-in hospitals, receiving large numbers of patients with gonorrheal vaginitis, it has been almost eradicated. The germs get into the eyes during the passage of the head through the vagina, or are washed into them by the attendant, or wiped into them by the mother. While the gonococcus is usually causative, the pneumococcus, the bacillus of diphtheria, and other germs may cause serious conjunctivitis. The child may be born with the disease already well advanced.

**Mode of Prevention.**—If the husband or wife is known to have gonorrhea, the vaginal inflammation is to be treated during pregnancy by the usual methods. Douches of 1:1500 potassium permanganate, given under low pressure, and applications of 25 per cent. argyrol tampons give good results. During labor the vagina is douched out every six hours with 1 per cent. lysol solution—this only in cases of gonorrhea, not for the routine delivery. The bag of waters must not be ruptured, but is to be allowed to come down and line the vagina for the passage of the head. It is best if the child of such a mother is delivered with a caul. During all vaginal examinations the eyes of the fetus (for example, in face presentation) must not be touched. When there is a purulent greenish vaginal discharge, or if there are condylomata on the vulva, the precautions are redoubled, the aim being to prevent all possibility of maternal secretions getting into the conjunctival sac. The same principle is carried out after the head is born, the vaginal mucus being removed at once from the neighborhood of the eyes with pledgets wrung dry from 1:1500 bichlorid, and great care observed to allow no *reinfection*.

The nurse is instructed always to observe this same care while giving baths, and the first cleansing is best made by an albolene or lard rub, to remove the vernix caseosa. When gonorrhea is present, oil rubs are substituted for the baths entirely. In maternity practice the child and its mother are rigidly isolated, because the disease is highly contagious.

Active antisepsis of the eyes may not be needed if the above method is practised, but it is best to disinfect the eyes as an additional precaution. Where gonorrhea is suspected in either parent, the old Credé method is used—a drop of 2 per cent. silver nitrate solution in each eye, neutralized immediately with salt solution.

As a routine, in hospital practice, the author uses 1 per cent. nitrate of silver solution and does not neutralize it, a practice also in vogue in the New York Lying-in Hospital, the University of Pennsylvania Maternity, and the Manhattan Maternity. The Johns Hopkins Maternity uses the 2 per cent. solution. In his private practice the author invariably employs some antiseptic, and at present uses 1 per cent. saphol solution with satisfactory results.

Other antiseptics have been recommended, as bichlorid, boric acid (useless), acetate of silver, argyrol, etc., but the author has found no reason to alter the practice outlined above.

Some practitioners use the drops immediately after the child is born, but the author prefers to wait until after the third stage is completed, so that he can do the

## CHAPTER XXII

### THE THIRD STAGE

women die from accidents of the third stage of labor than during the combined. On a proper conduct of this part of the delivery depend the freedom from postpartum hemorrhage, the expulsion of the secundines, the smooth convalescence during the puerperium, and even her health. Postpartum hemorrhage may be directly fatal, or may leave the patient permanently invalided; retention of pieces of placenta may be the cause of infections and lay the foundation for ineradicable disease. It is important, therefore, that the accoucheur be familiar with the physiology of the third stage, possess a good technic in its conduct. Baudelocque distinguished the third stage from the *expulsion* of the after-birth, and this difference must always be remembered. The same general principle applies to the treatment of this stage as to the first stage, the accoucheur studies the mechanism as it unrolls under hand and eye, and interferes only for good reason.

**of Conduct.**—As the child leaves the vagina the nurse or the assistant supports the receding uterus with the hand placed lightly upon it; a procedure recommended by John Harvey in 1767. After delivery the accoucheur supports the uterus through a sterile towel. No massage of the fundus is made; the hand simply rests on it, noting its firmness and the varying connection to contraction and relaxation. When the child has been severed from the mother, the accoucheur resumes his watch over the uterus, a warm, dry sheet is laid under the patient, a sterile basin or bed-pan is pushed under the perineum, taking care not to push feces upward onto the vulva. The cord is drawn up over the thigh, leaving a loop hanging so that it does not touch the bottom of the basin. The woman lies on her back, with the legs slightly apart and outstretched, according to her comfort. The abdomen is covered, but the vulva must be visible, for the accoucheur wishes to see if blood accumulates. If the woman has been delivered on the side, she is gently turned on her back. The conduct of the third stage, taking care to be certain that the legs are kept apart, only together, and that the uterus is very hard during the movement—contractions to avoid air-embolism, which has occurred (Braun).

The accoucheur now sits or stands at the side of the patient, and studies the progress of the separation of the placenta, and, in the absence of hemorrhage from the vulva or into the uterus, has nothing else to do for fifteen to thirty minutes. During this time the accoucheur notes the frequency and strength of the after-pains; the amount of blood accumulating in the basin. If the uterus remains firm and does not balloon out with blood; if there is no external bleeding—nothing to be feared, but if the uterus softens and fills up, or if there is external hemorrhage, gentle massage is practised. The four fingers make circles on the posterior surface of the fundus, while the thumb rests in front, the motion resembling kneading of bread. As soon as the uterus becomes firm the oozing will cease and bleeding may be discontinued. Inspection of the vulva will show whether the hemorrhage comes from some tear of the vulva or clitoris or from a point higher up the genital canal. In pathologic cases abnormalities of the separation of the placenta may cause hemorrhage, and then the treatment of the third stage has to be modified. (See p. 796.) The accoucheur waits for the signs that the placenta has been expelled and has been expelled from the uterus into the dilated lower uterine cavity and upper vagina. Strong uterine contractions themselves would indi-

cate this to the accoucheur, but there are other signs: (1) The cord becomes limp and advances 3 or 4 inches from the vulva (diagnosed by observing the longer loop in the basin); (2) the uterus rises up in the abdomen, usually to the right side, while below, over the pubis, a soft, boggy mass appears (the placenta); (3) the globular uterus has flattened out from before backward, presents a sharp ridge at the fundus, is more movable, smaller, and harder; (4) a flat dimple is palpable on the fundus; (5) firm pressure on the fundus fails to send a wave of blood through the cord—Pinard (unreliable).

These phenomena are apparent in ten to forty-five minutes, depending on the strength of the uterine contractions. When the placenta is surely out of the cavity of the uterus, there is no real need of waiting longer for its delivery; indeed, the author believes that it is better practice to remove it at this time, because there is



FIG. 326.—EARLY EXPRESSION.  
Uterus is used only as a medium to exert pressure on placenta.

less likelihood of blood-clots forming in the partially emptied parturient canal. On the average, twenty to twenty-five minutes elapse before the placenta is fully separated.

Now the attendant assures himself of three things—that the bladder is empty (catheterize, if necessary); that the uterus is in firm contraction (wait for an after-pain); that the uterus is in the median line (bring it there by pressure from the sides). The woman is asked to bear down, to see first if she can expel the placenta herself. If she cannot, the uterus is grasped in the whole hand with the thumb in front (Fig. 326) and gently pushed *without squeezing* down onto the placenta, in the axis of the inlet. The uterus is used simply as a piston, as a body through which to exert pressure on the placenta lying in the vagina, and this maneuver is

called "early expression"—"early," because it anticipates nature's expulsion. Williams calls it "expression from the vagina." As the placenta distends the vulva the woman usually bears down and expels it into the basin, into which it should be allowed to fall, dragging the membranes after it. It is best to allow the membranes to come out of their own weight, but if they should be adherent (evidenced by the placenta not falling into the basin), gentle, steady traction is made on them without twisting. One grasps the membranes near the vulva from above, to avoid contact with the suspected perineal and anal regions. If the membranes start to tear, greater gentleness is to be used, and if they should break off, the proximal end should be grasped with an artery forceps. Five minutes' time may be required to remove the secundines in an intact condition. Now the uterus is given a brisk massage, and the patient, one dram of ergot. This is not always necessary, but the author has never seen any harm from its use,



FIG. 327.—CREDÉ'S EXPRESSION.

Placenta is squeezed out of uterus, from which it has not yet been fully detached. Note the direction of the pressure.

and often felt that the uterus got harder and remained so more continuously when it was administered. Ergot is never given before the placenta is delivered.

If the first "early expression" does not bring the after-birth, a mistake has been made as to the placental separation, and the attendant waits for more definite signs to appear, when the simple expression is repeated. Unless the woman bleeds, there is no danger, and one may safely wait even eight or ten hours. If, after one hour, during which time two, or at most three, simple expressions have been attempted, the placenta fails to come, a Credé expression is performed, since the third stage is pathologic. Credé's expression differs from the simple form in that the uterus, at the same time that it is forced down into the pelvis, is squeezed from all sides, so that its contents are expelled "like the stone from a cherry" (Fig. 327).

Being assured that the bladder is empty and the uterus contracted, the fundus is grasped in the full hand with the thumb in front, and, while the fingers are pressed together, the uterus is firmly but gently forced down in the line of the axis of the pelvis. One Credé expression properly executed will almost always force the placenta into the vagina, and now the woman expels it or it may be delivered by simple expression. The further treatment of such a pathologic third stage belongs in the chapter on Postpartum Hemorrhage, p. 797.

**Other Methods of Treatment of Third Stage.**—Savage tribes and the ancients pulled on the cord, pressed on the belly, gave emetics or tickled the nose, to provoke sneezing, had the woman blow into a gourd, a bottle, or into the closed fist, to evoke the abdominal pressure, or even removed the placenta by hand. Hippocrates blew irritating powders into the nose, a practice that some physicians carry out today. The French, even now, exert traction on the cord together with pressure on the fundus, after the placenta is loosened and slipped from the uterus—a practice which is not dangerous in a skilled hand. The author would unreservedly condemn it, however, because—(1) Most of the deliveries are conducted by midwives who blindly imitate the physicians; (2) it is inefficient if the placenta is adherent or incarcerated; (3) the cord may tear off, or only part of the placenta may come with it; (4) traction on the placenta may cause inversion of the uterus; (5) there is danger of infection from the fingers inserted into the vagina. (6) it is not necessary. In 1861 Credé formulated a method which was given his name, and consisted in the rapid expression of the placenta by squeezing the uterus through the abdomen during the first after-pain, that is, from four to eight minutes after the delivery of the child. Dohrn and Ahlfeld, in 1880 and 1882, showed the dangers of this method—(a) It is unphysiologic; (b) the uterus is emptied too rapidly—it has not time to retract properly, it fills up with clots, and the tendency to late hemorrhage is increased; (c) the primary hemorrhage is great; (d) retention of the membranes, of decidua, and even of pieces of placenta are more common; (e) the uterus is bruised, painful after-pains and puerperal infection are invited.

Ahlfeld, in 1882, proposed a purely expectant plan of treatment of the third stage. The uterus is not even touched after delivery unless interference is necessary because of very profuse hemorrhage; the cord is drawn over the thigh, a bed-pan put under the vulva, or the patient is put over a hole in the mattress, the escaping blood is caught in a funnel leading to a graduated vessel under the bed, and the attendant sits at the bedside, watching her face and counting her pulse, occasionally taking note of the amount of blood lost externally. If the placenta is not born spontaneously in two hours, the woman is asked to bear down, and if she fails to expel it, the placenta is expressed as already indicated. As a rule, the placenta is spontaneously expelled in three or four hours, but without aid it might remain until putrefaction sets in. Ahlfeld claims for his method that the loss of blood is less than with Credé's; that the decidua are usually expelled complete; that the tearing and retention of the membranes and placenta are less frequent; that the puerperium is less likely to be morbid—with all of which the author cannot agree. In 60 consecutive cases in which this method was tried the author found the hemorrhage greater than with the method first described in this chapter, and there was no difference in the frequency of retention of pieces of membrane or decidua. Other investigators have confirmed these findings. Outside of the greater loss of blood, which may signify much to a small or anemic woman, the constant anxiety of the patient throughout the long hours of waiting, the prolongation of the possibility of infection, and the useless expenditure of the physician's time, condemn the method. In Dublin, since 1784, and in England, since 1775 (John Harvie), a method of treatment was practised whose essentials were the guarding of the uterus with the hand and the expression of the placenta by gentle force exerted on the fundus from the abdomen fifteen to thirty minutes after the child was delivered. The plan recommended by the author is based on the Dublin method.

One of the important functions of the obstetrician is to save the woman's blood. Even though the obstetric patient can lose enormous quantities—as much as three liters, according to Ahlfeld—without succumbing to hemorrhage, these great losses leave the woman debilitated, anemic, neurasthenic, and, if not these, at least protract her recovery decidedly. The author aims to conduct all labors as nearly bloodlessly as possible, and is strongly convinced that the women recuperate much quicker, suffer less infections, nurse their babies better, and altogether are more healthy and vigorous than those who have suffered the losses which are given as physiologic in most text-books. Excessive hemorrhage is produced by improper conduct of the third stage. The accoucheur should hurry the process of separation of the placenta only in the presence of an indication; rough massage of the uterus is to be avoided, since it mashes the soft placenta to a pulp, and a uterus that is behaving well should not be excited to irregular action. All these conduce to retention of pieces of placenta, hemorrhage, and infection. The same is true of improperly performed and frequent Credé expressions.

**Examination of the Placenta.**—This is a part of a physician's work which may never be omitted, hurried, nor delegated to another. A minute and systematic inspection of the after-birth is made as soon as it is delivered, while the hands are still sterile and the patient ready for operation. If postponed until the physician is about to leave the house and the patient already comfortably settled in bed, one is apt to disturb her and may neglect a small piece of placenta which may be found wanting, and trust its removal to nature, when, if everything were aseptically prepared, the uterus would be properly emptied of its contents, and late hemorrhages, atony, subinvolution, and puerperal infection thus avoided. It is well to repeat the inspection of the placenta before it is destroyed. Some country women make it a practice to preserve the placenta for five days, in order that the physician may inspect it if fever develops. Under a good light, and gently rubbing the blood-clots off the maternal surface with a piece of cotton without producing new



FIG. 328.—INSPECTION OF THE PLACENTA.

Before being taken from the bedside, a careful scrutiny of the placenta is made, all blood-clots being wiped away with dry gauze. Note posture of patient and the fact that the uterus is contracting.

injuries, the accoucheur goes carefully over each cotyledon separately and successively. Beginning at one point in the periphery, the edge is followed all around three times, and if it is smooth and even, in all likelihood nothing is missing, but the center of the placenta must also be examined carefully. A gray, smooth, shiny surface (the decidua serotina) is a positive indication that that portion is not missing, but a rough place requires careful attention. If the torn and roughened surfaces fit smoothly *without forcing the cotyledons together*; if the broken and jagged edges of the thin decidua serotina mortise into each other perfectly, one may decide that nothing is missing from that point. Every roughened portion of the placenta should be washed with water, and if the villi are seen free and floating, one may be certain that a larger or smaller portion of the organ has remained attached to the uterus.

Turning the organ inside out, the fetal surface is scrutinized, the presence of

cysts noted, but especially the distribution of vessels. If the vessels all disappear before they reach the edge, one may be fairly sure that a placenta succenturiata has not been left behind. If a large vessel breaks off sharply at the edge of the after-birth, search should be made for the portion it supplied (Fig. 329).

The membranes also must be studied. If the opening through which the infant came is round and complete, usually all the membranes are delivered. The empty ovum sac may be filled with water. If the membranes are in shreds, the parts may be fitted together or spread on a sterile towel. If torn from the edge of the pla-



FIG. 329.—EDGE OF PLACENTA, SHOWING APERTURE IN CHORION WHERE A PLACENTA SUCCENTURIATA HAS BEEN TORN OUT.

centa, they must be readjusted and notice taken if like fits like structures. The amnion is now studied separately from the chorion. Pieces of missing chorion always carry decidua with them, and are especially important because they may also carry a placenta succenturiata or placenta spuria with them.

**Discovery of the Absence of a Placenta Succenturiata.**—The possibility of the retention of an extra placenta is invariably to be borne in mind, especially since



on the minutest examination of the delivered portion may fail to give rise to suspicion of such an occurrence. High authorities have testified to this point in court. Still, an investigation with this particular object will rarely fail to discover the true conditions.

If the membranes are torn from the edge of the placenta, leaving the latter ragged, thick, and rough; if a blood-vessel runs to the edge of the placenta and breaks off sharply; if, with velamentous insertion of the cord, not all the vessels are accounted for; if there is an extra placenta on the one delivered; if, on holding the membranes up to light, an irregular defect in the chorion is found, with thickened and vascular margins; if the placenta is smaller than the size of the child could demand—one may feel reasonably sure that a placenta succenturiata is retained in the uterus. In cases of real doubt the uterine cavity is to be explored.

So complete an examination of the secundines requires all of ten minutes, during which time the nurse guards the uterus, stimulating it to contraction by gentle massage if necessary.

For experimental purposes milk could be injected into the placenta through the opening; it would flow in a large stream through the opening left by the missing portion.

**When to Invade the Uterus.**—Properly, this question comes up in the pathologic part, but, owing to its importance, it will bear frequent repetition. The invasion of the uterine cavity after parturition is a serious procedure, and, done as usually is, is more dangerous than most laparotomies, done as they usually are. Done as laparotomies are usually done, the introduction of the hand is not dangerous.

In his recommendations for general practice, therefore, a teacher is bound to consider the conditions there met, and the qualifications and limitations of the attendant physician.

In general practice it is safest to leave the membranes, if retained, for nature to dispose of, which she usually does—they come away with the lochia, in pieces or as a whole, by the end of one or two weeks. Severe after-pains, fetid lochia, a slight rise of temperature, a moderate bleeding, often accompany this condition, but the puerpera recovers, though a chronic endometritis may remain. Even if all the membranes are retained, the placenta being "decrowned," most authorities recommend non-interference in the absence of hemorrhage. A missing piece of placenta, unless it is larger than the thumb-nail, or unless it causes hemorrhage, is also left to the natural resources of the woman. The hand may be introduced into the uterus only under the strictest indication, vast experience having shown that, under conditions in which most of human births occur, the woman is safer if the above measures are applied and much trusted to nature.

On the other hand, where the parturient is in an aseptic maternity hospital, and where the accoucheur has at his service all the accoutrements of aseptic operation, he may make the attempt to spare the woman the ills that follow the retention in the uterus of membrane, shreds of thick decidua, scraps of placental tissue, and even blood-clots. Persistent oozing of blood, which sometimes causes decided general anemia before it ceases spontaneously, severe after-pains, fetid lochia, slight pyrophobic infections, prolonged lochial discharge, persistence of lochia rubra, protracted convalescence, late puerperal hemorrhages, subinvolution of the uterus, which may result in chronic metritis, with sterility and permanent invalidism, mild metritis with later shrinking of the uterine ligaments—all these may be avoided by leaving the uterine cavity empty and the walls smooth after delivery. It must be again repeated, however, that unless the conditions for aseptic operation are perfect, the primary danger of infection far outweighs the advantages to be gained.

**The Asepsis and Antisepsis of the Second and Third Stages.**—Antiseptic surgery has very properly given way to aseptic surgery. The principle of aseptic surgery has been carried over to obstetrics, but a few of the old antiseptic practices

have been and must be retained. An example will illustrate the need for this: A parturient is ideally prepared for delivery, with sterile night-gown, sterile leggings, sterile sheets and towels, all safely (?) pinned together, with a sterile towel under the buttocks, leaving only the vulvar orifice exposed; the accoucheur is dressed as for a major laparotomy. What happens? The woman, in her throes of pain, tosses about, disarranging all the sterile covers; she grasps the hand of the attendant, or puts her hand over the sterile towels to the vulva; she coughs or expires forcibly and droplets of saliva are blown on to the sterile cloths; with the pressing efforts feces escape from the rectum, and soil the towel under her or the towel at the side of the buttock, and with her next motion these are spread all over the region about the vulva; the second stage drags on, one, two, or three hours, dust settles on the extensive area of sheets, leggings, towels, gloves, gowns, basins, etc., which are supposed to be sterile. How many of these things are really sterile when the actual time of delivery arrives and may safely be touched? In view of these experiences, and be-



FIG. 330.—PATIENT DRESSED FOR DELIVERY—MATERNITY PRACTICE.

Although the large area of sheets, etc., was sterile when first exposed, it soon must be regarded as not so, and may not be touched. Only the towel on the belly and the vulva may be touched by the sterile hand.

cause the immense majority of confinements must be conducted without so many conveniences, the author practises and teaches a very simple system of antiseptics. The bed is dressed with sterile sheets; the patient is in a sterile night-gown; sterile leggings are put on; a sterile towel lies under the buttocks; another covers the belly, but nothing is draped near the vulva, and the only towel which is considered aseptic, and kept so by frequent changes, is the one on the belly. If it is impossible to obtain the sterile clothes, clean ones, fresh from the laundry, are as good, for they are not touched anyway (Fig. 330). The accoucheur must put on a sterilised gown, which is not considered sterile after it is on, and use sterilized rubber gloves but these must be considered sterile and must be kept so by very frequent dipping in actively antiseptic solutions. He wears a mouth and head cover.

The inside of basins carrying antiseptic solutions, the hands (gloved), the region immediately around the vulva, and the towel on the belly are the only objects which are considered sterile, and which the accoucheur tries to keep sterile. If feces issue from the rectum, they are caught in sponges wrung out of 1 : 1500

bichlorid, and the region of the anus washed with the same. If the woman touches the abdominal towel, a new one replaces it, and during the second stage the vulva and introitus vaginae are frequently sponged with 1 per cent. lysol and 1 : 1500 bichlorid solutions. Since the child is delivered "inter feces et urinas," the field can never be considered aseptic. The author has never seen ill effects from the liberal use of these antiseptic solutions on the introitus vulvæ and perineum, and, since investigations have proved that the greatest danger of infection arises from this region, the above practice is justified. Experience in his own private and consultation practice and in the large service of the Chicago Lying-in Hospital and Dispensary has also convinced him that, if the region of the vulva is kept aseptic with antiseptic solutions; if the gloves are kept sterile by frequent immersions in the same, and if the few objects that must necessarily be introduced into the genitalia are absolutely aseptic, one can conduct the most difficult and prolonged obstetric manipulations in the dirtiest hovel with brilliant results.

Wherever possible, naturally, and in obstetric operations, the precautions and technic of the laparotomy are practised (Fig. 330\*).

When the child is delivered, the hand follows the uterus through the sterile abdominal towel. After the cord is tied the accoucheur rinses his gloves very thoroughly in both solutions (1 : 1500 bichlorid and 1 per cent. lysol), which are made up fresh, with fresh pledgets. For the conduct of the third stage he removes the gloves, sterilizes the hands, and draws on fresh sterile gloves. If there is no time for this, the author washes his gloves with pure lysol. New gloves are put on when one has inadvertently touched some unsterile object or perforated the first pair. After the placenta is delivered, the vulva and parts about it are washed gently with 1 : 1500 bichlorid, taking care that nothing is washed into the cervical wound. If one is called to a case of injury to the perineum, where no preparation of the patient had been previously made, it would be an error of technic to rub the vulva with soap and water, etc., and thus carry infection into the wound. One should treat such a case as one would a compound fracture, that is, clean well the edges, guarding carefully against carrying anything into the freshly lacerated surfaces. The contiguous skin is painted with tincture of iodine by some means.

**Examination of the Parts for Injuries.**—Lacerations of the outlet may be observed during the delivery of the child, but the attendant must also inspect the parts carefully after the third stage. Having sponged the blood away, the fingers, holding two dry pledgets, gently, under good light, separate the labia so that a perfect view of the vagina and perineum is obtained. Thus the kind and extent of the birth lacerations are discovered. Unless there is hemorrhage, the author does not search for cervical tears after spontaneous deliveries. In all breech, in excessively rapid, and in all operative deliveries the author insists on a careful exploration of the whole parturient canal, followed by catheterization and rectal examination, to determine the integrity of all the structures involved in the labor process.

### SUMMARY OF THE CONDUCT OF THE THREE STAGES

*During the First Stage.*—(1) Asepsis and antisepsis. (2) Diagnosis of the case. (3) The prognosis of the mechanism of labor. (4) Watchful expectancy and recognition of impending danger to mother and babe. (5) Attention to bladder, bowels, and general health of patient. (6) Relief of pain.

*During the Second Stage.*—(1) Asepsis and antisepsis. (2) Relief of pain. (3) Protection of life of infant and watching for complications which threaten the mother. (4) The preservation of the perineum.

\* See article by author, "Several Every-day Obstetric Problems," Amer. Jour. Obstet., July, 1917.

*During the Third Stage.*—(1) Prevention of postpartum hemorrhage. Delivery of the placenta. (3) Asepsis and antisepsis. (4) Tying the cord. Care of the eyes. (6) Examination of the placenta. (7) The search for injuries. (8) Examination of the child for deformities and injury.

The accoucheur stays in the house at least one hour after the placenta is delivered, time which may be profitably employed watching the mother for hemorrhage, eclampsia, etc., in cleaning instruments and packing satchel ready for the case, the filling out of the history sheet or card and birth-certificate, weighing and measuring the baby, giving instructions as to after-care, etc. Before leaving the house the attendant must have assured himself on these seven points: (1) the uterus is in firm tonus—that is, well retracted and not inverted; (2) there is no hemorrhage from the vulvar orifice and no internal hemorrhage; (3) that the placenta and membranes are complete; (4) that the bladder is empty; (5) that all perineal tears are attended to; (6) that the child is in good condition, no hemorrhage from the cord, and that it breathes freely; (7) that the mother is in good condition, with good pulse, no headache (eclampsia), no vomiting.

Let us pause here to take a glance back at the treatment of labor as a whole. It should be regarded as a surgical operation: it really is such, and the obstetrician is really a surgeon. He considers every labor, therefore, first, as to the ability of the patient to stand the shock; second, he provides for asepsis and antisepsis; third, he carefully watches for and guards against complications.

During the labor the accoucheur observes the powers and estimates the chances, judges whether the powers are sufficient to overcome the latter; he watches the mechanism of labor as its various phases pass under the eye and hand; he is always alert to any abnormality in the mechanism, and keenly alive to the possibility of some outside complication occurring, which may throw either of his patients into acute danger. Through all, he throws around both patients the protection from infection which, of recent years, has become almost perfect.

The conduct of labor is not a simple matter, safely intrusted to every one. Let the people know that having a child is an important affair, deserving the deepest solicitation on the part of the friends, needing the watchful attention of a qualified practitioner, and that the care of even a normal confinement is the dignity of the greatest surgeon.

## CHAPTER XXIII

### THE CONDUCT OF THE PUERPERIUM

At the delivery of the placenta the vulvar region is cleansed of blood, etc., by the physician, and a sterilized vulvar pad applied, which is held in place by a bandage.

An abdominal bandage is generally used to hold the pad and to relieve the puerpera from the feeling of emptiness. Such a binder cannot be applied tight enough to compress the uterus and thus prevent postpartum hemorrhage, but it should, therefore, only support the abdominal wall, and be loose enough to enable the nurse to put her hand underneath for the palpation of the fundus.

Douches are given postpartum except for some special indication, *e. g.*, pyrexia, etc. When the soiled sheets are drawn from the bed and the patient's dress changed, the woman should be moved with great gentleness, and one should see that the legs be kept close together and that the uterus be held hard—these measures to prevent air-embolism. If the uterovaginal tract has been tamponed, the moving of the puerpera is slowly and gently done, because of the danger of pushing the uterus over the tampon. The bed is now set to rights, the room is darkened, the mother warmly covered up, a warm-water bag placed at the feet, a hot drink given, and she is allowed to get the repose and sleep she has earned. By this time another hour has passed, and if hemorrhage has not occurred and the third stage was conducted properly, few complications need to be feared, though it is wise for the nurse to take an occasional look at the patient.

The treatment of the puerperium falls almost entirely to the nurse, but it is the duty of the accoucheur to have his own ideas on the subject and to be able to carry them out, if necessary. In a book, "Obstetrics for Nurses," the author has detailed the details of such treatment, which would hardly find a place in a text-book for practitioners.

**Care During the Puerperium.**—This is as important as during the labor, for many cases have been successfully delivered only to be infected in the puerperium. The vulva is treated as an open wound—indeed, it is beset by the same dangers as an open wound. This point is to be remembered when comparing obstetrical with surgical practice. The pads lying on the vulva are changed as often as they become soiled with blood or lochia, and the parts are dressed after each urination and defecation, also as a routine three or four times a day. For this purpose the patient is placed on a sterile bed-pan, the nurse sterilizes her hands or wears sterile gloves, and gently pours from a narrow-lipped pitcher a solution of 1 : 2000 boric acid over the vulva. The excess is dried off without rubbing, by touching with sterile cotton, and a fresh sterile vulvar pad is applied. Simple sterilized water may be used. If there is any odor to the lochia, 2 per cent. carbolic solution is used as a disinfectant. These attentions are needed for ten days. No douches are given during the Puerperium (p. 898), and the patient is instructed never to touch her genitals nor her nipples. Internal examinations are not made by the nurse, except under strictest indication. The parts are left severely alone. If there are stitches in the perineum, extra care and greater watchfulness are required on the part of the nurse and accoucheur, since unclean bed-pans, non-sterile cloths, and bed-covers may come in direct contact with the wound.

**Diet.**—There is no ground for the old notion that errors of diet cause puerperal infection. Even a healthy person, put to bed with a full dietary, will soon complain of headache, indigestion, etc., because the food without exercise is not properly oxidized. During the first eighteen hours after the labor the patient should have liquids in amounts sufficient to quench her thirst. After a few hours a cup of broth or tea and a small slice of buttered toast may be given. Milk, plain or with seltzer, is allowable, also tea, coffee, milk-toast,

oyster-stew, salt wafers, and chocolate. On the second day, after the bowels have moved freely, the amounts may be increased, and the patient may have soups, thickened with rice, barley, etc., bread and butter, cereal foods, and stewed fruits, omitting the strongly acid. In summer ice-cream and ices are allowable. On this day a small piece of meat, as a chop, the breast of chicken, or squab, may be given at noon. Fresh fish is also now allowable. The other meals are prepared from the dietary of the preceding days. On the fourth day a small piece of tender steak, eggs, light puddings, blanc-mange, baked apple, jellies, and other delicacies may be given. Tea and coffee are given sparingly and should not be strong. Fresh vegetables are allowed, with salt or cream dressing, not vinegar. Baked potatoes, beans, and peas are best omitted, as they may produce tympany. Stewed fruits, as prunes, dried apples, and peaches, are given for their laxative effect. After the fifth day the diet is as above and this has been found sufficient for the patient until she is up and about.

Three meals a day are served. At ten in the morning a glass of cool milk, and at three in the afternoon a cup of chocolate with a wafer, are given. Occasionally an eggnog is prepared instead of the chocolate at three. At midnight, after the nursing, a glass of hot milk or malted milk is usually administered.

Throughout the puerperium the nurse will see that the patient drinks pure water freely, to make up the loss caused by the free action of the skin and kidneys and the fluids required for making milk.

*Foods to be Avoided.*—Acid fruits, as lemons, grape-fruit, oranges (sour), plums, strawberries, boiled tomatoes, onions, are to be avoided. These are likely to cause colic in the infant, but after a few weeks the mother should gradually add these to her diet, to accustom the infant to them. Potatoes, beans, peas, lentils, and turnips cause flatus and tympany in the mother and sometimes in the child, and should also be avoided until the mother is up and about. Highly spiced dishes, heavy or spiced sauces, dressings, such as French and mayonnaise, are all to be avoided—they throw too much work on the kidneys.

If the breasts are engorged, the liquids are to be restricted. If the patient has had eclampsia, a water or milk and water diet is ordered.

**The Bladder.**—The necessity for frequent emptying of the bladder during labor has been emphasized. During the third stage it may fill rapidly, incarcerate the placenta, and cause postpartum hemorrhage. The bladder must always be emptied within the first ten hours after delivery, and thereafter at least three times a day. Owing to the bruising of the neck of the bladder, the edema of the neck and the urethra, and spasm of the sphincter, plus the horizontal position, the patient may not be able to urinate. Before the catheter is resorted to, these methods should be tried: (a) Have the nurse put the woman on a bed-pan containing steaming hot water, and leave her alone; (b) the same, and allow the water to run in the wash-stand; (c) let the patient, while lying on the bed-pan, smell a bottle of sal volatile; (d) lay a large pad, dripping with warm sterile water, on the pubis (the warm solution imitates the flow of urine); (e) place a hot fomentation over the bladder; (f) give the patient an enema: often the bowels and bladder act simultaneously; (g) gentle pressure on the bladder may start the flow; (h) let the patient sit up on the pan, this being less dangerous than catheterization. With all these measures a little suggestion may be used, and the patient is to be left alone. Many people cannot urinate in the presence of another. If the bladder must be catheterized, it is wisest for the accoucheur to do this himself, unless he has a trustworthy nurse, because many cases of cystitis take origin at this time. After the bladder is once thus emptied, the patient can usually urinate herself thereafter, but if the operation must be repeated, it should not be done oftener than every eight hours, and hexamethylenamin, 5 grains thrice daily, should be administered prophylactically.

*Method.*—The patient is arranged on a clean bed-pan under good light, as for a dressing, all the necessary solutions and soft-rubber catheters being close at hand. The nurse sterilizes her hands, sponges the vulva generously with 1:2000 bichlorid, and wipes out the mouth of the urethra with 1 per cent. lysol solution on a cotton applicator. With the urethral opening in full sight, the catheter is gently passed into the bladder, and the urine collected in a clean vessel for inspection. If the first pass finds the catheter in the vagina,—owing to the greatly bruised and swollen condition of the parts it is not always easy to find the opening,—another catheter must be used or the first one resterilized.

**The Bowels.**—Custom immemorial gives a cathartic on the third day after labor. The author prefers to give it on the morning of the second day, and usually prescribes castor oil. The oil is said to favor the secretion of milk: at least it does not reduce the flow, as do the saline cathartics. Castor oil was cultivated and used in Egypt seventeen hundred years before Christ. The oil is administered

in sherry and whisky, in orange-juice, in the froth of beer, or in gelatin capsules. After the bowels are once thoroughly evacuated, a daily enema is sufficient to unload the rectum, but these movements are often unsatisfactory, and an occasional dose of cascara at bedtime ought also to be given. Constipation is the rule for two or three weeks postpartum, but usually, when the patient resumes her customary duties, the condition improves. When the patient has a complete perineal laceration, the attention to the bowels becomes a very important item of treatment. (See p. 756.) If the woman has too much milk, or if the breasts are engorged and painful, salines, Rochelle salts, effervescent citrate of magnesia, or magnesium sulphate may be prescribed.

**The Breasts.**—After the mother has slept, usually about eight hours, the nurse prepares the breasts. They are gently washed with soap and water, then with bichlorid 1 : 1500, which is allowed to dry in. A loose breast-binder is now applied, simply to prevent the glands from sagging. Tertullian tells us that the Roman women used a breast-binder made in the temples and possessing mystic powers.

A short time after this the baby is applied to the nipple. Before and after each nursing the nipple is washed with saturated boric-acid solution, poured fresh from a bottle, not kept in a glass, using sterilized cotton pledgets on toothpicks, known as "applicators" (Fig. 331). The fingers do not come in contact with the nipple at all; if it is necessary to do this, the hands must be disinfected. The baby is put to the breast every

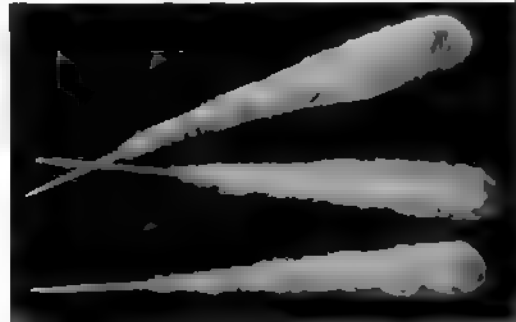


FIG. 331.—COTTON-WRAPPED TOOTH-PICKS, KNOWN AS APPLICATORS.

four hours until the milk comes, then every three hours during the day and once during the night. The first nursing is at 7 A.M., the last at 10 P.M. Later in the puerperium the child is allowed to sleep as long as it will, and finally it is habituated to sleep all night through. When the milk "comes in," which usually occurs on the third day, the breasts need more support from the breast-binder. The treatment of cracks, engorgement, and other conditions of the breast will be taken up in the chapter on Complications. Too much care and too careful asepsis cannot be given to the breasts, as infection, with resulting abscess and impaired nipples, with resulting necessary weaning of the child, must be avoided.

The question of nursing is an important one. Every mother should nurse her child, for her own good, because it favors involution of the genitalia and develops the maternal instinct, but principally because it reduces the terrific mortality of the first months of life. Fully 25 per cent. of children die in the first year of life, and a large proportion of the deaths is due to bottle-feeding.

It has been said that a bottle-fed baby never became great, a statement which appears reasonable, but has never been proved. Without doubt the public is awakening to the importance of maternal nursing, and now it is considered by most women a real calamity if they cannot give their offspring the breast. Certain contraindications to nursing exist. General diseases, tuberculosis, pernicious anemia, cancer, contraindicate it, because the disease is likely to become very active during lactation. Severe hemorrhage in labor retards the nursing, but with full diet the patient may give her breast to the child for half or more of its feedings. Syphilis does not forbid nursing. Only its own mother may nurse a syphilitic child. A healthy child never comes from a syphilitic mother. The new serum tests for syphilis have proved this.

Malformation of the breasts, as deformed, inverted, cracked, and split nipples,

may preclude nursing. The latter often are healed by proper treatment. Mastitis commands the suspension of nursing for a few days, and an abscess forbids it permanently from the affected breast. A weak, puny, or hare-lipped child may not be able to nurse, and in these cases the milk is to be pumped and fed to the infant.

Remarkable as it may seem, the milk of some mothers may act like an irritant poison to the infant and may produce enteritis or even death. The milk in the next puerperium may be normal; or the milk may be poor in quality, not agreeing well with the child, but agreeing with another; or there may be a scarcity of milk. Attempts specifically to alter the quality of the milk have been unsatisfactory. The patient's general health must be improved. If there is a scarcity of mother's milk, one may try to stimulate the glands—first, by daily massage, Bier's vacuum treatment, cold bathing of the whole body, giving much fluid to drink, especially milk, water, cocoa, gruels, and oyster-stews, but no tea, coffee, beer, or malt liquor. The last two fatten the patient and reduce the milk-supply. A strong baby is the best stimulant to the breasts, and if this fails to bring milk, usually there is no gland tissue there and all efforts will be futile. Occasionally the milk-supply is not abundant until the patient is up and about and takes outdoor exercise.

Artificial feeding is not resorted to unless the mother is obviously unable to meet the demands made on her, and when it is demonstrated, by the condition of the baby, that the breasts are inefficient. Before attempting substitute feeding it is best for the baby that a wet-nurse be obtained.

**Pulse and Temperature.**—The nurse should take the pulse, temperature, and respiration at least morning and evening, better, every six hours,—at 6, 12, 6, and 12,—and record the same on a carefully kept history sheet. The pulse may be counted frequently during the first five days, and the temperature taken if it shows any increase in rate. The pulse is a more sensitive indicator of abnormalities than the temperature, but the latter is more certain, since the pulse is very mobile. Any temperature above 99.5° F. should be considered abnormal and its cause sought. Chills normally are absent from the puerperium. The author is very suspicious of "nervous chills"—they usually are not nervous, but due to infection. The pulse normally ranges from 66 to 80; a decrease below 66 is not pathologic, but an increase over 90 should direct our attention to the patient. If the patient has no nurse, the temperature is taken by the physician during his visit, and he leaves a thermometer with the patient, instructing her to hold it in her mouth at a certain time, then to lay it aside for him to read at his next visit.

**The Doctor's Visit.**—A daily visit to the puerpera is desirable, but not necessary if she has a good nurse. It is important that the patient be seen on the third, fourth, and fifth days, because these are the critical ones. The nurse will keep a record of all the happenings to both mother and child. The nurse is supplied by the author with special blanks for this purpose, and she also fills, for his files, the card shown herewith (Fig. 332). It is well for the physician himself to inspect the vulva, the pads, the breasts, and the nipples for evidences of disease, and to palpate the uterus to determine its state of involution. He must watch the retrogressive changes of the puerperium, and be alert to the first beginning deviation from the normal, as infection, subinvolution. He must study the progress of the repair of the puerperal wounds to discover early any abnormality here, like necrosis of tissue, inflammatory infiltration, exudate, and he must be acquainted with the general state of health of the puerpera, so as to be able to recognize, before they occur, impending accidents, as eclampsia, yellow atrophy of the liver, septicemia, puerperal insanity. Of particular significance is the passage of clots, since this indicates something wrong in the uterus. Very few medicines are prescribed in a normal puerperium—really none save cathartics and an occasional remedy for after-pains.

**After-pains.**—Multiparæ suffer more with painful uterine contractions than do primiparæ. Occurring in the latter, they give rise to the suspicion of infection or the retention of clots or placental fragments in the uterus. They are due to lack of



nus of the uterine muscle. Unless very severe, keeping the patient awake, morphia is not given, a trial first being made with a combination of phenacetin, sodium carbonate, and caffeine, or sodium bromid, or aspirin, or local applications, hot mentations, camphorated oil, or a hot saline enema.

**Sleep.**—It is highly important that the puerpera obtain sufficient real sleep as well as rest. One of the symptoms, and perhaps a contributory cause, of puerperal insanity is lack of sleep.

After the patient has been cared for on the completion of labor, she is allowed sleep as long as possible, and the room is darkened and quieted to favor this. Subsequently the nurse must arrange the duties of the day so that the puerpera has little nap in the afternoon, and at least eight hours' good sleep at night. If the puerpera is persistently sleepless, the physician should be notified. The cause of the sleeplessness must be investigated, and if there is a family history of mental disease, the condition must be cured at once. The author has tried suggestion with

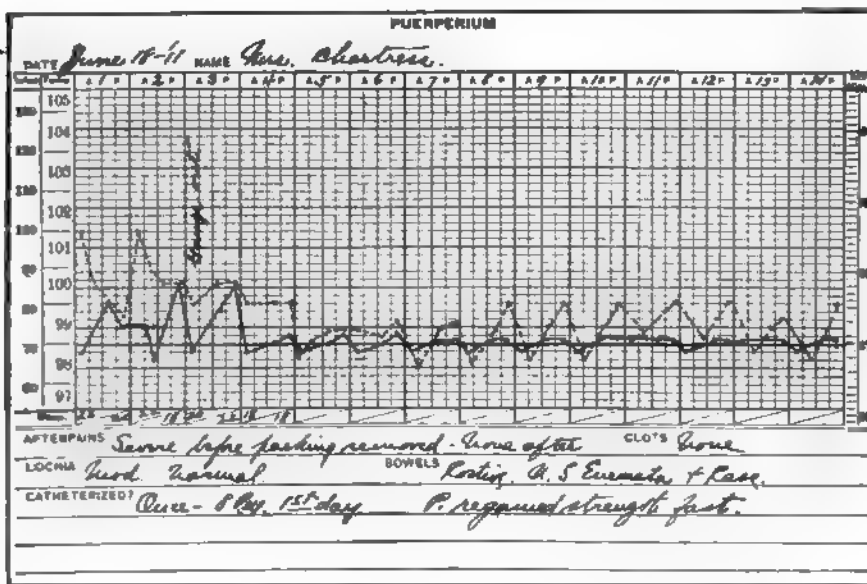


FIG. 332.—A FILLED POSTPARTUM CARD. REVERSE IS USED FOR THE CHILD'S RECORD (FIG. 335).

good effect, also sodium bromid in 20-grain doses, veronal in 5-grain doses, and chloralamid, 5 to 15 grains, but where the woman is tired out, nervous, excited, and evidently under a strain, a hypodermic of  $\frac{1}{6}$  grain morphia with  $\frac{1}{100}$  grain atropin could be given. The danger of inaugurating the morphia habit is always to be borne in mind, and the patient properly guarded against it. Much can be done by the nurse to procure sleep, as giving a warm alcohol sponge-bath, a glass of hot salted milk, cultivation of a regular habit of sleep, removal of the infant from the room, and a constant cheerful, hopeful demeanor, withholding worries of all kinds from the patient's mind.

**General Treatment.**—This is the same as for any bed patient as regards bathing, changing bed, and so forth. Unless the weather makes it agreeable, a full bath is not needed every day, but may be given twice or thrice a week. Daily, however, the whole body may be sponged with alcohol and water, one part to three, paying special attention to the axillæ. There should be plenty of light and fresh air in the lying-in chamber. Sun and air are not harmful by any means. In the olden time both were feared, and the puerpera was kept in semi-darkness all the time, and all air excluded to prevent her from catching cold. It was thought that "catching cold" caused puerperal infection and mastitis, but now we know these complications are due to infection, and are in high degree preventable by proper asepsis. Free

ventilation and light are strong opponents to infection. The nurse, while providing both, must see that at no time either mother or child is exposed to a direct draft, and that the bright light does not fall directly on the eyes of either.

After the first week the nurse may give the patient a general light massage. She should avoid the inside of the legs, where there are veins, and the uterus and breasts. Passive motions of the arms, legs, and trunk are also recommended. Systematic motions of the arms and legs, such as extending and flexing them against a slight resistance, may be practised. These exercises while away the tedium of the bed, improve the circulation, strengthen the abdominal muscles, and hasten the return of the patient's strength. She is less likely to be faint and weak when first gotten out of bed. (See *Obstetrics for Nurses*, 1917.)

**Visitors.**—The lying-in room should be quiet and restful. The puerpera must be given opportunity to recover from the strain of labor and recuperate her strength from the exhaustion of pregnancy and delivery. Therefore only the nearest relatives are to be allowed in the lying-in chamber during the first week. Even these visits should be very short. Aside from the nervous disturbance caused by too many visitors, there is the danger of the introduction of contagion.

**The Time of Getting Up.**—The author allows a normal puerpera, after normal labor, to sit up in bed on the sixth or seventh day, get out of bed into a large chair for an hour on the ninth or tenth day, for three hours on the eleventh, and before the end of the second week she has the freedom of the floor, going downstairs on the fifteenth to eighteenth day. Operative cases, perineorrhaphies, and women who have had fever during the puerperium require special regulations—usually a prolongation of the stay in bed and slower resumption of active movements. But the women are not condemned to such absolute quiet in the bed as formerly. For the first two or three hours the puerpera should lie quietly on her back, but after this she may be turned gently on the side, the nurse supporting the heavy uterus. Next day the position may be changed oftener, and by the third day only ordinary care is necessary, and the changes may be made as frequently as comfort demands. These changes facilitate drainage and better the pelvic circulation. The puerpera after the fourth day may be propped up with pillows or back-rest for her meals, bowel movements, and urinations, may sit up straight on the sixth day, but her perfect condition and her frequent requests to be let out of bed should not lead the physician to permit it until the ninth or tenth day. It is wise, too, to forbid too early resumption of household duties, responsibilities, and social functions.

This time-honored custom of keeping the woman in bed nine days or more has been assailed by late writers. Küstner, in 1899, and White, as far back as 1775, advocated the practice of allowing the women to leave the bed as soon as they felt able to do so, and claimed that no evil results followed, but, on the contrary, the women recovered strength quicker, had less fever, less frequent thrombophlebitis, less coprostasis, less necessity for catheterization, better lactation, and no greater frequency of prolapse of the uterus and vagina.

It is probable that those physicians who keep their puerperæ in bed two, three, or even four weeks err in the opposite direction, and it is certain that one can let the women get up too soon. The best plan will, as usual, be a compromise between the two, and the limits be applied to special cases. One must hesitate long before allowing a principle, grounded in thousands of years of empiricism, to be overthrown by a new theory, and, indeed, the early getting up does not possess all the advantages claimed, nor is it free from the dangers it is said to be. In the first place, theoretic consideration of the condition of the pelvis postpartum will indicate the necessity for rest in the horizontal position. The bruised, suggillated condition of the pelvic floor has already been referred to. It stands to reason that such an impaired pelvic floor should not be given the task of supporting the large heavy puerperal uterus and the whole intra-abdominal pressure before it has regained, in a measure, its strength and elasticity. The ancient idea that too early getting up leads to prolapse of the vagina and uterus has anatomic foundation, and, further, clinical experience proves it. Prolapse is more common in the poor women who have to get up early after delivery and do heavy work. It is common among Indians.

It is claimed that fever is less frequent. The author believes that fever is more frequent. In the service of the Chicago Lying-in Hospital Dispensary, in nearly every case where the puerpera is reported to have fever the history reads that the patient had gotten out of bed and soon after sickened. We know that the streptococcus—and a virulent strain too—normally inhabits the puerperal vagina. When the puerpera gets up, the heavy uterus falls to and fro and tears open the granulating surfaces, giving the germs access to the lymph-spaces. Statistics have not

proved all the claims for the new treatment. More about this interesting subject must be sought in the literature, of which much has accumulated in the last few years. (See Mosher and Küstner.\*)

**The Binder.**—Ancient custom prescribes the application of an abdominal binder directly postpartum. Van Swieten (1754) recommended it for the prevention of syncope, the raising up of the uterus, and postpartum hemorrhage. It does not place the feeling of emptiness of which the women complain after delivery, but it will not prevent the uterus from rising in the belly or from bleeding, no matter how tightly applied. The women insist on the application of the binder throughout the puerperium, with a view to preserving the figure and preventing "high stomach." In the author's opinion, the binder will do neither. Enteroptosis, nephroptosis, relaxed abdominal wall, are the results of congenital deformity, pathogenic conditions acquired before or during pregnancy,—for example, overstretching of the abdominal walls,—and very little may be done during the puerperium to correct these effects. The author applies the binder postpartum to relieve the feeling of emptiness of the abdomen, to help steady the uterus when the patient is moved, and to satisfy her whims. Hardly any objection can be offered to its use. It is almost impossible to apply it tightly enough to force the uterus backward, but it may, if it compans develops, interfere with the passage of flatus and feces, which is especially true after cesarean section. During the second week of the puerperium a very gentle superficial abdominal massage and mild gymnastics are used to strengthen the muscles. By preventing the accumulation of gas in the bowels and providing a daily alvine evacuation, the above treatment is aided. After the patient assumes the erect posture, the abdominal binder may assist greatly, by supporting the weight of the viscera for a short time until the recti and obliqui have regained sufficient tone and power. The abdominal binder used after laparotomy may be applied, and a jockeystrip may be worn. The latter furnishes also some slight perineal support. Corsets may be resumed after five weeks, and the variety which holds up the lower abdomen should be preferred.

**Final Examination.**—The patient is instructed to appear for examination at the office of the accoucheur with her baby eight weeks after delivery. By this time involution is complete, the woman has had the first menstruation, if it was to occur, and one can better judge of the condition of the parts. Special attention is directed to the size and position of the uterus, the presence of exudates in the broad ligaments, the condition of the adnexa, the firmness of the levator ani and perineum, and the state of the bladder and vaginal walls as regards prolapse. If the uterus is retroverted, it is to be replaced and a pessary inserted, which the patient should wear three months. If the perineal floor is relaxed, the patient is instructed how to exercise the levator ani, to take the knee-chest position for ten minutes three times a day, and is given a prescription for hot vaginal douches. Other gynecologic treatment or operation is advised if necessary, and the opportunity is used to discover the very beginnings of postpuerperal disease and to correct them. If the woman has had a severe labor, she is advised as to a subsequent pregnancy.

The child is examined for umbilical hernia, and its nutritional state determined. These points are all to be noted on the puerperium card, which entry closes the obstetric history of the particular case.

## SUMMARY OF THE PRINCIPLES OF TREATMENT OF THE PUERPERIUM

1. Antisepsis and asepsis of the open genital wounds.
2. Asepsis of the breasts.
3. Attention to the emunctories, bowels, urinary tract, and skin.
4. Provisions for comfort, sleep, and relief of pain.
5. Watchfulness for complications.

\* Küstner: *Verh. der Deutsch. Gesell. f. Gyn.*, vol. viii, p. 530. White: *The Treatment of Pregnant and Puerperal Women*, 1775. Mosher: *Amer. Jour. Obstet.*, 1911, vol. xlv.

6. General treatment to facilitate recovery.
7. The time of getting up.
8. Final examination to prevent future invalidism.

### THE DIAGNOSIS OF THE PUERPERIUM

Chiefly in legal cases is the accoucheur required to give an opinion as to the existence of the puerperal state. At postmortems on women dead after an illegal operation, as criminal abortion, it is usually easy to determine the exact condition, from the macroscopic and microscopic appearance of the parts. If a woman pleads the puerperal state for the purposes of blackmail or for the substitution of an infant, it is usually a simple matter to discover the fraud, but if a labor has actually taken place and the patient wishes to hide her condition, as, for example, in cases of child murder, it is not so easy to prove incontestably that gestation has preceded the examination. Naturally, the difficulties increase with the length of time since delivery. A full-term labor also leaves greater and more permanent traces than an abortion. No reliance may be placed on the statements of the patient or her friends.

The examination includes a search for the changes of the puerperium, especially for the presence of a functioning breast (not traces of milk or colostrum) and for the evidences of fresh wounds in the genital tract. The vulva has a quite characteristic, reddish purple, velvety, succulent appearance for the first four weeks postpartum, and the presence of the typical birth injuries undergoing the usual changes of wound healing lends great weight to the diagnosis. Absence of such injuries does not eliminate the possibility of previous delivery, because the fetus may have been small or macerated, or the parts especially elastic. The presence of vestiges of the hymen—*carunculæ myrtiformes*—is indicative, not conclusive. Cervical tears are usually due to child-birth, but sometimes come from instrumentation, as dilatation for dysmenorrhea or sterility. The enlargement of the uterus, directly or shortly after labor, its consistence, its contractions, and its rapid decrease in size, determined by repeated bimanuals and measurements with the sound, give valuable information, both as to the fact and to the time of a previous confinement. If the cervix is patulous, a finger may be inserted and feel the placental site. Less reliance than one would expect may be placed on a study of the lochia and scrapings. One must find ovular remnants to clinch the diagnosis. Vernix caseosa, meconium, but especially pieces of placenta or chorionic villi are positive. Decidual cells, when in very large numbers, are presumptive evidence, but one must find villi to arrive at positiveness. Opitz\* believed he could diagnose a preëxisting pregnancy from the construction of the uterine glands thus removed. Later investigations have disproved this, but a study of the scrapings will give very strong evidences of puerperal changes if done early enough. The presence of hyaline remnants of blood-vessels in the scrapings even six months postpartum is said to be good evidence. (See changes in the uterine mucous membrane during involution, p. 213.) Since the patient may refuse to permit a curetage on the ground that it is dangerous to her, and justifiably, we are usually without this kind of information. Abortion in progress or a fibroid may simulate the puerperium. After an early abortion it may be impossible to distinguish the puerperal uterus from one that is menstruating. Abderhalden's serum test for pregnancy is unreliable. It behooves the obstetric expert to be very thorough and systematic in his examination, very deliberate in his consideration of the findings, and very circumspect in his statements on the witness-stand in such cases as the above. A full record is to be made of every examination. These should be gotten up in legal form, the help of an attorney being asked if necessary.

\* Opitz: Zeitschr. f. Geb. u. Gyn., vol. xlii.

## SECTION V

# THE NEW-BORN CHILD

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### CHAPTER XXIV

#### PHYSIOLOGY OF THE NEW-BORN CHILD

AT no period during the life of the individual does he undergo such violent and fundamental changes as at birth and during the two weeks after it. Not a few children fail to survive the shock of delivery, and a great many succumb in the first few weeks because of their inability to meet and overcome the adverse conditions surrounding their lives. The new-born must now do its own digesting, must oxygenate its own blood from the air, which is of varying temperature, must keep up its body warmth in spite of violent external variations, and, besides other functions, must take care of hosts of bacteria which assail it from every port of entrance. True, it brings into the world certain acquired immunities against infection, but it must develop a great many itself.

The changes of the fetal to the extra-uterine circulation and the establishment of respiration have already been considered.

**Respiration.**—At first the breathing is very irregular and abdominal in type; later it becomes more even and more thoracic, becoming abdominothoracic during crying efforts. The respirations are both superficial and deep, occasionally intermittent, and vary from 35 to 60, even in health. The child inspires from 20 to 40 c.c. with each breath, the amount increasing rapidly each day. The exchange of gases in the lungs is more than twice as active as in the adult. Oxidation in the body is also more active, assimilative processes and growth being so vigorous and marked. At first only a small portion of the lung is expanded, and it requires a month or more to expand it all. The chest-wall is so poorly developed that when the pleural cavities are opened, the lungs do not collapse, as in the adult.

Crying is good for the child, because it expands the lungs. A whining, grunting expiration is a sign that the alveoli are not developed, as occurs in premature, asphyxiated, or injured children. Mucus in the trachea causes rattling; it may come from congestion of the throat the result of labor, or from aspiration of vaginal or other discharges during the delivery. This is dangerous on the score of mechanical obstruction of the air-passages (atelectasis) and infection, bronchopneumonia, and enteritis.

The blood is more concentrated than that of adults (specific gravity, 1060 to 1080), and contains more hemoglobin and salts. It clots feebly, and contains no diastatic ferment, as in the adult (Bial). The amount varies from 250 to 350 gm., depending on the size of the child and the time of ligation of the cord, being, with late ligation, about one-eleventh of the body weight. Chury says it is one-twentieth of the body weight. Leukocytosis is the rule for the first few days—up to 23,000; later, an average of about 10,000 to 12,000 is attained. The polynuclears are in the majority early, but after the twelfth day the lymphocytes preponderate. Owing to the thickening of the blood in the first days the reds are increased in number—from 5,000,000 to 6,500,000, but soon the normal is reëstablished, because of the destruction of about 10 per cent. of them. The size of the red corpuscles varies very much,

there being many microcytes. Poikilocytosis also may be found, and, for four to nine days, nucleated reds.

Halban and Landsteiner studied the serum of the child, and found that it possesses less antitoxic, bactericidal, and hemolytic properties than the adult's, and that, therefore, the blood is not complete.

The *circulation*, studied by Seitz, of Munich, shows marked changes. During fetal life the pulse-beats number 120 to 150; after delivery, 150 to 190; sinking to 110, then rising to 120 to 130 a minute on the fourth to sixth day, with many variations of frequency, and rhythm, and strength, caused by sleep, waking, crying, colic, etc. The blood-pressure varies from 60 to 80 mm., and since the arteries

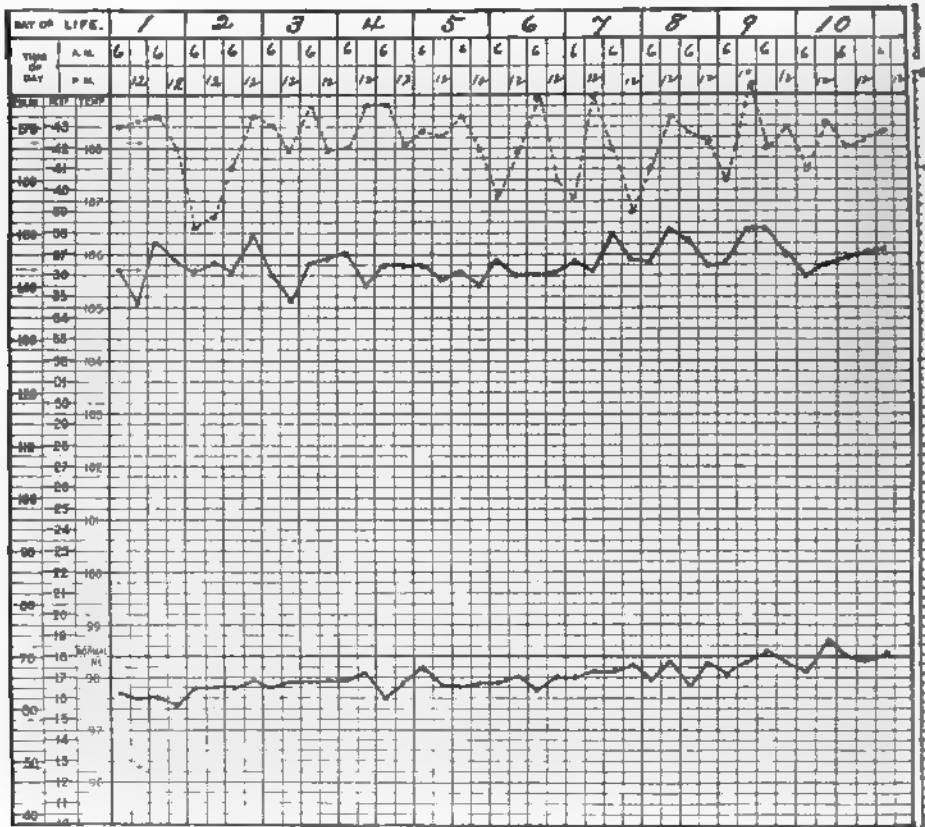


FIG. 333. TEMPERATURE, PULSE, AND RESPIRATION CHART OF NEW-BORN.

The average readings of ten apparently healthy children were taken. The pulse and respiration in every instance were counted with the stethoscope. Records were made at 6 A. M., 12 noon, 6 P. M., and 12 midnight. Dotted line is the respiration, the lowest line, the temperature.

and capillaries of the child are large, the peripheral resistance is less, allowing a more active and rapid circulation of the blood. This is needful for the rapid development of all the organs, the active digestion, and tissue growth of the child.

**The Temperature.**—Owing to the fetus' own metabolism, the intra-uterine temperature is one-half degree higher at birth than that of the mother (Fig. 333). As the result of the exposure following delivery, the temperature sinks 1 to  $3\frac{1}{2}$  degrees greater in premature and asphyxiated children. After twelve to twenty hours the normal,  $98^{\circ}$  F., is reached. After a week or so the temperature remains around  $98.6^{\circ}$  F. Bathing, nursing, exposure, lack of food, etc., easily alter the temperature of the child. Diurnal variations are not usual.

**The Urine.**—Reusing presents this table of the daily average amounts of urine:

	1	2	3	4	5	6	7	8	day
Breast-fed . . . . .	18.9	38.6	64.9	84.0	121.5	147.0	175.5	217.2	c.c.
Bottle-fed . . . . .	28.8	59.7	111.4	153.8	198.9	237.7	278.7	371.0	c.c.

From  $7\frac{1}{2}$  to 9 c.c. of urine may be found in the bladder at birth. Later, daily amounts vary very much with the size of the child, prematurity, the room temperature and moisture (incubator children pass less urine), the food (mother's milk, less urine), icterus, and illness. If the baby is a water-tippler, the bed may be wet all the time. The specific gravity is from 1006 to 1008; color, clear, watery, later a light straw; reaction acid. Urea shows highest on the seventh day—0.8 per cent., from 0.1 per cent. on the first day. The percentage of uric acid is large, as is shown by the frequency of uric-acid infarct of the kidney. It is nearly thrice as much as in the adult, a condition which also exists in the blood (Sedgwick). Uric-acid infarct of the kidney occurs in 50 per cent. of children, and may be assumed from a microscopic examination of the urine showing the crystals. Often the crystals (ammonium urate principally) are found on the diaper as a reddish brick-dust. When a kidney containing the infarct is cut, it grits under the knife, and yellowish or brownish streaks are seen radiating from the papillæ. The deposit occurs oftener in premature children, after prolonged or instrumental deliveries, after asphyxia, in cases of delayed lactation, with icterus and febrile complications. The granules may cause pain in their passage. Nephritis is not uncommon in early infancy (Jacobi). Albuminuria is very common—almost constant for four to seven days. Acidosis with convulsions may occur within the first few days.

**The Intestinal Tract.**—Shortly after birth the meconium which has accumulated in the large intestine is discharged. Occasionally a plug of mucus which filled the rectum precedes the green, thick, pasty meconium. There are 70 to 90 gm. of meconium (Camerer), and it is usually all passed by the third or fourth day. The colostrum has a laxative action, and air and gas in the bowel aid the active peristalsis of the first days. The green discharge is followed by brown, then yellow movements, if the child is fed at the breast, but the discharges are whitish and curdy if the child is fed by the bottle. Meconium contains epithelium from the intestine, bilirubin, cholesterin crystals, stearic acid, fat, bile, lanugo, skin epithelium, and sebaceous matter from swallowed liquor amnii.

Within twenty-four hours the whole intestinal canal is infected by the enterococcus and the *Bacterium coli commune* and other bacteria present in the air, the bath-water, the vagina of the mother, and on the fingers and lips of the mother and nurse. Without doubt many infections of serious nature originate at this time, and, too, the germs introduced may be beneficial, since they aid the process of digestion. Ordinarily the child's intestine is inhabited mainly by two forms—the *Bacterium coli* and the *Bacillus lactis aërogenes*.

Normally, the infant has two stools daily—more, if bottle fed. In the latter the odor is not that of sour milk, as it is with healthy infants, and one is more likely to find clumps of fat, formerly thought to be casein, in the movement.

The stomach contains pepsin; the pancreas, trypsin and a fat-splitting ferment, but no diastatic ferment (Zweifel).

**The Weight.**—During the first four days the infant loses in weight—on the average, six to eight ounces. The loss is more in bottle-fed babies and those getting scanty food. The birth weight is regained by the tenth day, and from then on the normal, breast-fed infant should gain about an ounce a day. The initial loss is due to excretion of meconium, urine, evaporation, and to the fact that the new-

born gets very little nourishment in the first few days. Such losses do not occur in animals, and they have important bearing on the diseases of early infancy. (See Bailey and Murlin.) The table from Beuthner gives the average amounts of food taken by children from the breast for the first fourteen days:

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Average birth-weight, 3126 gm....	17	91	190	302	348	381	450	476	476	476	476	476	476	476

If more food is given the child in the first days, the initial loss in weight is not so great or may be avoided. Premature infants lose relatively more and regain their birth-weight very slowly, often requiring a month. The same is true of

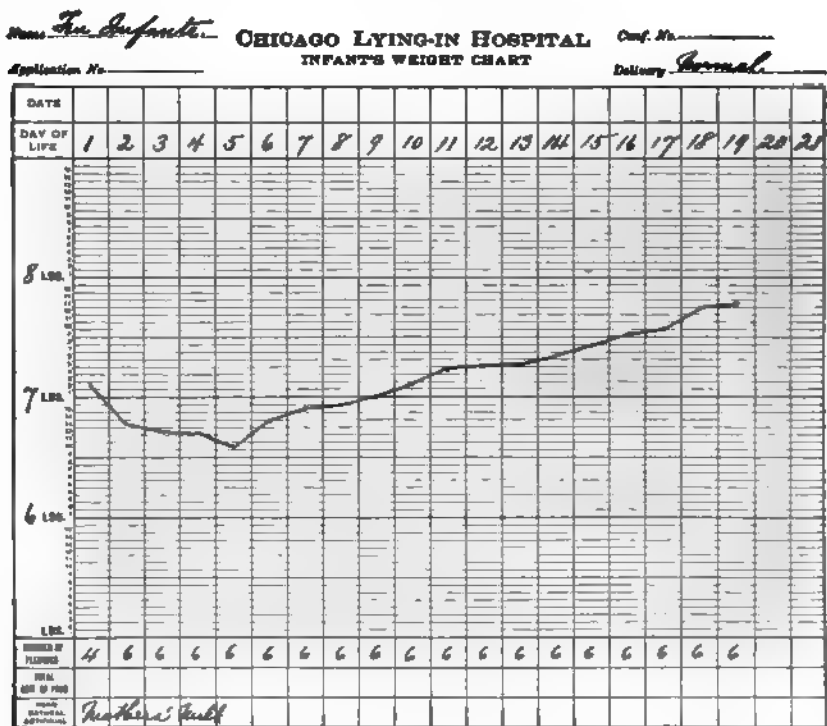


FIG. 334.—CHART SHOWING AVERAGE WEIGHT OF 10 APPARENTLY NORMAL BREAST-FED INFANTS.

excessively large children. Children fed on cow's milk lose more weight and regain flesh less rapidly than breast-fed infants. Since nearly as large a percentage of cow's milk as of human milk is absorbed (93 and 96 per cent.), there must be other reasons for the inferiority of cow's milk as an infant food. It is well known that breast-fed children grow faster, are more vigorous, resist infections better, throw off disease quicker, suffer less from rickets, etc., than the bottle-fed. Human milk is easier to digest. Fewer calories of it are required. Its albumin is partly in solution as a homologous albumin, ready for absorption into the blood without the preparatory stages of propeptone, peptone, and albumose; it contains phosphorus in very assimilable form, as nuclein, lecithin, and opalisin. It is not a dead secretion, but a live tissue, and carries ferments which render the milk easily absorbed, and which, added to cow's milk, will even render the latter much more assimilable. This fact, known clinically for many years, has been emphasized by Marfan and



herich, who call these ferments or enzymes, trophozymases. Human milk contains diastatic, proteolytic, fibrin- and fat-splitting ferments, also alexoic ferments (Moro). The latter causes alexins to be developed in the child's blood, which give it immunities against disease. Ehrlich proved that immune bodies pass from the mother to the fetus and from mother to child through the milk (Seitz).

**General Condition.**—Observing the child after birth, it is seen to be in a half-awake state. The eyes are opened once in a while, but immediately closed, the child moves, also the legs, sometimes quite vigorously. The difference between sleeping and waking is not very well marked until the end of the first week or even later. The special senses, touch and taste are already well developed. Sight is probably, the light reflex is certainly, present. Hearing is sometimes determinable as early as the first day, but usually is positively present only toward the end of the first week. The sense of smell develops later.

The spinal nervous system is in a state of hyperexcitability, the infant jumping even at slight jarring, and the will is certainly developed early, as one may judge from the rapid acquisition of bad habits. Reaction to electric stimulation is slower.

**The Skin.**—At first the child is cyanotic, especially about the face and extremities, and the eyelids may be swollen. After thirty or forty minutes the normal pink of the new-born appears, unless the infant is premature, when the color is dusky red. Over the back and in the creases of the body a thick white paste is often found—the vernix caseosa. This consists of fatty skin secretions, epidermis, and lanugo, and is usually removed by oiling with the first bath. In many children the epidermis exfoliates in branny scales, or there may be pronounced squamation. In the latter cases, which may be toxemic, the skin looks a little raw at first and may crack, but later a healthy pink or white appears. During the first weeks the skin is subject to various eruptions, especially vesicular and pustular. They are called strophulus—red, if the border of the vesicles is red, and white, if purely vesicular. These are usually affections of the sweat-glands. There may also be a generalized erythema. A pustular eruption is generally due to infection with the *Staphylococcus albus*. In summer the tendency to skin affections is marked, vesicular intertrigo being an annoying complication, and in general the child is more sensitive to the action of soap and water, irritating clothing, insufficiently rinsed diapers, etc.

**Icterus Neonatorum.**—About 20 per cent. of children show slight icterus during the first week. Two varieties must be distinguished—icterus simplex and icterus toxicus. The latter is a symptom of sepsis, syphilis, Buhl's disease, the hemorrhagic diathesis, congenital obstruction in the bile-passages, etc. A peculiar and fatal form of icterus affecting the ganglia of the brain is described. Here only the benign form will be considered—the simple jaundice or icterus neonatorum.

Most authors place the percentage of jaundiced infants at about 80, but the experience of the writer is that even 20 per cent. is too high. With the aseptic care of the new-born and more physiologic treatment the minority of infants develop even a trace of icterus. On the second or third day one notices a slight yellowish tinge of the skin of the body and face, which may be better seen if the normal redness be pressed away by the finger. In marked cases even the sclera may become yellow, the nasal discharges and the urine also showing the discoloration, bile-stained sediment having been found in them. Autopsy shows that the intima of the arteries, cartilages, and the interstitial tissues are stained, but the brain and cord, the liver and the kidneys, very slightly, if any. The kidneys often contain the uric acid infarct. Icteric children usually are thin, grow less vigorously, show signs of gastro-intestinal inflammation, are colicky, subject to febrile disturbances, intertrigo of the buttocks, and generally are poorer than the others, for which reasons the author cannot call the affection a physiologic manifestation. The

excretion of urea and uric acid is greater, more albumin is used up, oxidation is more rapid (Hofmeier).

After the first week the jaundice has usually disappeared, but if it was severe, three to five weeks may be necessary. Much depends on the cause.

*Etiology.*—The cases occur with equal frequency in hospital and private practice, in town and city. Jaundice is more common in the children of primiparae, after long and hard instrumental deliveries, breech cases, in premature or atelectatic infants; it is more common in boys than in girls, and in the children of young mothers; it may be a familial characteristic.

The jaundice is probably due to the action of several causes. Since bile acids have been found in the pericardial fluid, the liver must be causative of the icterus. This hepatogenic action is aided by the increased destruction of red blood-corpuscles, which occurs in the first weeks, though most authors do not believe that the jaundice is entirely hematogenic in origin.

There are many theories, for example—(1) Obstruction of the ductus choledochus by mucus or epithelium; (2) edema of Glisson's capsule; (3) changes in the circulation of the blood in the liver; (4) absorption of the bile from the intestines, which may take place directly into the blood or the general circulation, as a result of the persistence of the ductus Arantii; deficient excretion of bile (Hess); (5) imperfect action of liver cells, disturbed perhaps by injury, toxemia, or infection.

Infection has been given as a cause, and for severe cases is usually active. Gessner believes that infection of the umbilicus will explain many cases, and in this the author fully agrees. Intestinal infection will explain more of them.

The prognosis is good in the simple icterus, but one should reserve expression of opinion until the severe forms of disease are excluded. It is wise to regard all cases of jaundice as significant, and examine the infant carefully to exclude syphilis, sepsis, etc.

The treatment is symptomatic. It has seemed to the author that the cases get better quicker on treatment directed to intestinal disinfection—castor oil, followed by calomel, with gastric and colonic lavage.

### LOCAL CHANGES

*Separation of the Cord.*—At the insertion of the cord into the belly the amnion covering the cord passes into the skin. If the skin runs up onto the cord, it is called "skin navel"; if the amnion runs down onto the abdomen, "amnion navel," the latter being rare. Vessels from the arteries of the abdomen make a circle around the navel and send up tiny branches which end  $\frac{1}{2}$  to  $\frac{1}{4}$  inch on the cord itself. The piece of cord not in connection with this circulation must necrose and fall off.

After a few hours one can see evidences of a reactive inflammation at the point of union of dead and living tissue, the skin around the insertion of the cord becoming red and swollen. White blood-corpuscles wander out and soften the cord at its junction with the body until a layer of granulations is fully formed separating the cord at its base. The dried stump finally drops off, the arteries giving way first, and then the vein. The surface of the navel is covered with very fine granulations; the center is retracted, the sides falling in; epithelium forms over the surface very quickly, and the navel is thus cicatrized. The cord drops off from the fourth to the twelfth day. The majority of authors give the average as the fifth day. Our experience has been much different. With the older methods of treatment of the stump it was exceptional for the cord to drop off before the end of the week. Now the cord is tied close to the insertion in the skin (but not involving it), and under aseptic treatment it falls off in three to six days—seldom later than the eighth.

There are two ways in which the cord behaves—mummification and moist

gangrene. The first occurs when the cord is kept warm and dry, the second when it is wrapped in oily dressings and evaporation is prevented. The drying-up of the cord is more common, less dangerous, and is to be favored. A large, thick cord dries up late, and some authors advise to strip all the jelly of Wharton from the cord, so as to favor the rapid mummification.

The umbilical vein collapses, the walls adhere, and normally there is no thrombosis. The hypogastric arteries collapse, and, owing to the thick muscular layer, are quite obliterated, but a small clot almost always is found in them. This should not present the appearance of pus.

The staphylococcus, streptococcus, and various non-pathogenic bacteria have been found in a large proportion of cords of healthy children. They were much more in number and much earlier found in the days when moist gangrene of the cord commonly occurred. The method of dressing the navel had a great deal to do with it. Separation of the cord takes place earlier in large, strong children, later in premature children; earlier in healthy children, later in sick children; later if wet, earlier if dry, gangrene of the cord occurs. The sinking in of the center of the wound is due to the retraction of the intra-abdominal part of the arteries. The healing of the navel is complete on the third or fourth day after the dropping of the cord.

The **breasts** of some new-born children show an interesting phenomenon. On the third or fourth day they enlarge, become hard, and occasionally secrete a little watery milk, with yellowish streaks. Microscopically, it resembles the colostrum, and colostrum corpuscles may be found. On the fifth or sixth day a fluid resembling milk in color and taste may be pressed out. This continues for two to four weeks if the gland be irritated, but if let alone, the secretion dries up and disappears. In rare cases a little fluid can be expressed after a year. This condition must be distinguished from true mastitis of the infant, a disease which does occur. The secretion is called by the Germans "Hexen-Milch," witch's milk, and occurs in boys as well as in girls—really it seems to occur oftener in boys than in girls; in weak as well as in strong children. The cause of the action of the breasts is unknown. Bayer believes it is due to the presence of the same ferment which causes the maternal milk secretion. He has found also an enlargement of the uterus of the new-born girl, which he likewise ascribes to maternal influence. The breasts should be let alone. Wash them with soap and water, pad them lightly with cotton, and tie a bandage over them. *Do not squeeze them.*

In about 1 case out of 20 the female infant will present a phenomenon resembling menstruation. The flow may last from one to six days, and be very slight or profuse. It usually is not attended with symptoms, but if very free, may produce evident malaise in the child. This pseudo-menstruation is more common in the children of primiparæ, after prolonged and operative and breech deliveries, and may be associated as a symptom with hemorrhage into the brain. Its causes are various. Perhaps it may be the result of stimulation of the ovaries by parturition, and have analogy with the enlargement of the breasts and uterus above referred to. Perhaps the child has absorbed some of the internal ovarian secretion of the mother. For a masterly consideration of the physiology and pathology of the new-born, see *von Reuss, Die Erkrankungen des Neugeborenen*, Berlin, 1914, Springer.

## CHAPTER XXV

### THE CARE OF THE CHILD

WHILE the third stage of labor is being conducted, and the accoucheur and nurse are devoting their attention to the mother, the infant lies in its crib, securely and warmly wrapped up, or is given in the care of a relative or neighbor, who is instructed to look at the navel occasionally for possible bleeding and see that the infant does not choke with mucus. After the confinement room is set to rights, the nurse takes the baby and dresses it, preferably in an adjoining apartment, to avoid disturbing the sleeping mother. First the whole body is rubbed with warm, sterile, solid albolene or benzoinated lard, paying particular attention to the places where the vernix accumulates. The fat dissolves the vernix, and the little body is now smoothly rubbed clean with a soft towel. No bath is given. Next the stump of the cord and the navel region are washed with 1 : 2000 bichlorid or 95 per cent. alcohol, and the wound dressed with sterilized gauze, a sterile belly-band being put over this primary surgical dressing. Then the eyes are treated after Credé's or some prophylactic method, if this has not been done before, and the child quickly and warmly dressed, after which it is placed in its crib, with a warm-water bag at its feet. All this must be done near a fire, away from chilling drafts, and the navel must be dressed with sterile hands if the wound is touched with the fingers.

**The Bath.**—Long custom prescribed a daily bath for the child. This is not to be recommended, because the infant is likely to be chilled and the wash-water may get to the eyes, navel, vulva, and mouth, causing infections; further, the poor soaps often used may cause eczema and various skin eruptions.

Until the umbilicus is healed, the child should not be given a tub-bath. The head and face are sponged daily with lukewarm water, using a little Castile soap, if necessary. The buttocks, when soiled, are sponged with cool water. The body is gently rubbed with benzoinated lard; this is removed by means of a soft towel, and this is usually all that is needed to keep the infant sweet and clean. After the cord is off and the navel cicatrized, the child is given a full bath. In summer the child may be given a sponge-bath instead of the oiling, because the perspiration and fat macerate the skin.

Dusting-powders are usually not needed, as with good care the infant will not chafe. One of the best of these is stearate of zinc. In hospitals the nurses must be made aware of the dangers of carrying skin diseases and infections, especially syphilis, gonorrhea, and pemphigus, from one child to another, and they should be instructed to report at once any evidences of disease on the child.

**Attention to the Cord.**—The navel is treated like any surgical open wound. While the binder is changed as often as it becomes soiled, the dressing of the cord is not disturbed unless it has been dislodged or gotten wet. After soaking off the gauze with 1 : 2000 bichlorid, the stump is washed with 95 per cent. alcohol, and a new dry gauze dressing applied. Dusting-powders are not used unless the stump shows signs of moist gangrene, when a mixture of 1 part salicylic acid to 20 parts of starch (sterilized) is applied. A wet dressing of 50 per cent. alcohol applied for six hours will usually cure it, and is recommended especially for signs of infection around the stump. During all these manipulations the nurse does not touch the wound unless she sterilizes her hands. Sterile applicators are used.

*The Eyes.* Only the outside of the eyelids is washed with a little sterile

ter, or, what is just as good, sterile boric solution. Unless there is some irritation or infection of the eyes, they do not need any treatment. The nurse is to be instructed to report at once by telephone or messenger the first sign of inflammation of the conjunctiva.

**The Bowels.**—The author recommends the routine administration of 10 drops castor oil to the infant on the day after the day of birth. This evacuates the ænion and any matters swallowed during delivery, and does much to prevent colic. Later an occasional repetition of the dose, and salt solution colonic flushings, given with a funnel attached to a soft-rubber catheter, will keep the intestinal tract in order. The mouth and tongue are not cleansed unless required, and then with gentleness, to avoid rubbing off the delicate epithelium. Wounds thus produced may form the atrium of infection, especially at the pillars of the fauces (Lednar's aphthæ). Excoriation of the anal region seldom occurs with breastfeeding, but is usual with bottle-feeding. Absolute cleanliness of the parts, frequent change of the diaper, the invariable use of washed, well-rinsed, and ironed diapers, cool ablutions, avoidance of friction, moderate use of dusting-powders, stearate of zinc, will do much to prevent and cure the intertrigo, but, best of all, will be the procuring of a proper food for the infant.

**Urination.**—If the infant does not urinate within twelve hours, the parts are to be examined for congenital deformity. A tight prepuce is almost never the cause. Either the infant has not had enough water or food, or it passes water unobserved in its bath, or has an attack of renal congestion, perhaps even nephritis. In such cases uric-acid infarct is usually found. Sepsis may also cause anuria, also absorption of toxins from the bowel and all febrile affections. The treatment is on general lines—free catharsis, administration of much water, moderate use of mother's milk, warm fomentations over the bladder and kidneys, a sitz-bath, a prolonged colonic flushing, and, finally, the catheter. The author had one case where a female child, apparently healthy, passed no urine for three days. Catheterization brought a few drams of thick, highly colored urine, after which the function became normal. The brick-dust sediment in the urine and on the diaper consists of uric-acid crystals of ammonium urate. They may cause pain during voiding and they indicate the need of more water.

**The Feeding.**—Eight to twelve hours after birth the child is put to the breast, and usually by this time the mother has rested. Thereafter, until the milk comes in, the infant nurses every four hours, and then every three hours for the first two weeks, after which the period is lengthened to three and one-half hours. After the first week, unless required, the child is not fed after 10 P. M. No attempt is made to sterilize the child's mouth by washing, because it is impossible and harmful, and it invites the infection it seeks to avoid. The nursing lasts ten to fifteen minutes, and the nurse must be sure that the infant really swallows the milk. It is occasionally necessary to give water between the feedings, but the nurse is to be warned of the uselessness and dangers of the habit of water-tipping. The child usually needs little extra liquid. If the child does not take the breast willingly, an investigation may reveal a poorly shaped nipple, a too full breast, difficult flow of milk, milk that does not agree with the child, and which it instinctively refuses, salty or bitter milk, or, finally, there may be none in the breast. Much patience is required to teach the infant how to suck, and wide differences exist in the capabilities of nurses to do this. If there is any doubt of the child getting enough nourishment, it should be weighed before and after each feeding.

For the first few days water, an ounce every two hours, and the colostrum from the breasts usually suffice for the wants of the infant, but if it should cry from hunger, a dram of cream to an ounce of water or a very weak milk of "peptogenic powder" may be given. In hospitals the infant may obtain an occasional feeding from one of the other mothers until its own mother has milk. The possibility of the contagion of syphilis in maternities must never be forgotten. The author

is very skeptical regarding the "starvation fever" so often mentioned as occurring at this period. Probably most of such temperatures are due to infection—intestinal, bronchial, faucial, or from the navel. (See Jaschke.)

AHLFELD'S TABLE

	NUMBER OF NURSINGS	AVERAGE AMOUNT DRUNK AT EACH NURSING	TOTAL GRAMS	TOTAL OUNCES
1st day . . . . .	2	2.5 grams	5.0 grams	1¾ dram
2d " . . . . .	5	29.0 "	149.0 "	4½ oz.
3d " . . . . .	6	41.0 "	246.0 "	8½ "
4th " . . . . .	7	58.8 "	401.6 "	13¾ "
5th " . . . . .	6	67.5 "	405.0 "	13¾ "
6th " . . . . .	7	73.0 "	511.0 "	17 "
7th " . . . . .	6	92.2 "	553.2 "	18½ "
8th " . . . . .	7	97.0 "	589.0 "	23 "
9th " . . . . .	6	93.0 "	558.0 "	18½ "
10th " . . . . .	7	86.0 "	602.0 "	20 "
11th " . . . . .	6	96.0 "	576.0 "	19½ "
12th " . . . . .	6	93.0 "	558.0 "	18½ "
13th " . . . . .	7	86.0 "	602.0 "	20 "
14th " . . . . .	7	91.0 "	637.0 "	21¼ "
15th " . . . . .	6	93.0 "	558.0 "	18½ "
16th " . . . . .	7	90.0 "	630.0 "	21 "
17th " . . . . .	7	92.0 "	644.0 "	21½ "
18th " . . . . .	6	96.0 "	576.0 "	19½ "
19th " . . . . .	7	105.0 "	735.0 "	24½ "
20th " . . . . .	6	112.0 "	672.0 "	22¼ "
21st " . . . . .	7	102.0 "	714.0 "	23½ "

Without doubt the best food for the infant comes from its mother's breasts and if she be absolutely unable to nurse, before employing artificial food a wet nurse should be obtained.

**Weighing the Infant.**—The child should be weighed directly after birth, and

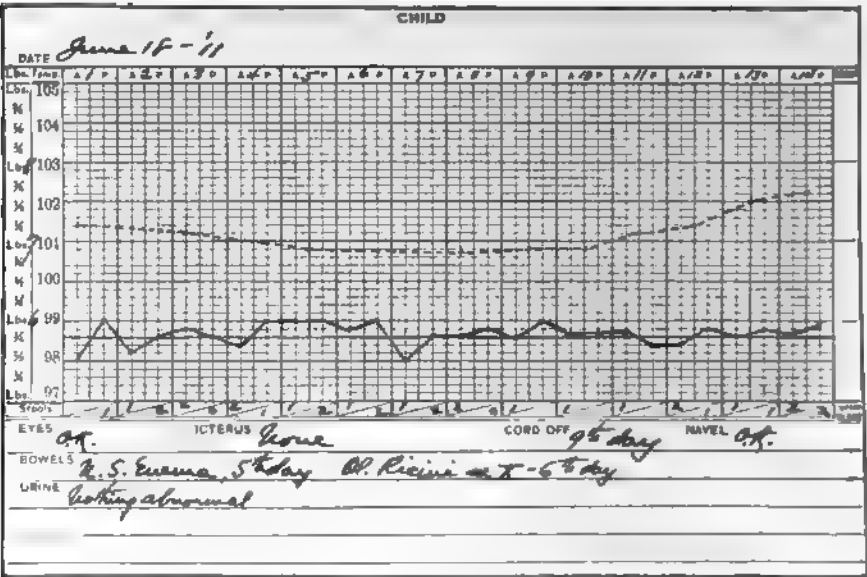


FIG. 335. INFANT'S RECORD. DOTTED LINE SHOWS WEIGHT. SOLID LINE, TEMPERATURE.

daily for several weeks. The beautiful "baby scales" on the market are qu impractical, and should be replaced by the ordinary grocers' scale with a scoop, ir weights, and a scale-bar for the ounces.

**Temperature, Pulse, and Respiration.**—The first of these must be taken tw

ily, and the others occasionally, all of which is to be recorded (Fig. 335) on the story sheet, the same as for the mother.

*General.*—A quiet, undisturbed, ordered life is to be provided the new individual, as habits formed now are permanent. Plenty of fresh air is as necessary to the infant as for the adult, and without doubt most babies are cuddled too much. The child should sleep in a room with a temperature of from 66°–68° F., and for the first six weeks its eyes should be protected from bright, glaring light. It is not to be disturbed except for attentions to itself, and when being lifted, should be guarded against injury. The nurse must be instructed not to let the nursling get into bad habits—water-tipling, peppermint-water tipling, whisky and water and crème-de-la-crème tipling, sucking on the finger, nursing-bottle, or nipple, sleeping with mother, being taken up when it cries, or rocked, held, and carried except when sick. By proper training the child can be taught regular habits, to sleep all night and between nursings, and to cry only when hungry, uncomfortable, or ill.

During his professional visit the physician pays some attention to the infant also. He must especially discover the first signs of malnutrition, because, unless this is early remedied, structural changes occur in the intestinal mucosa and the nervous system which may leave an impress for bad on the child's whole life. This is the reason the author insists so strongly on the wet-nurse when the mother cannot nourish her offspring. The physician watches the physiologic changes which adapt the child to extra-uterine existence, and decides each day if they are proceeding normally. The condition of the navel and eyes claims his special attention.

#### SUMMARY OF THE CARE OF THE INFANT

1. Asepsis and antisepsis of the navel, eyes, and orifices of the body.
2. Watching for evidences of sickness.
3. Attention to excretories—bowels, kidneys, and skin.
4. Feeding and nutrition.
5. The healing of the navel.

For details of the care and treatment of the infant the reader is referred to the author's *Obstetrics for Nurses*.

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## PART II

# THE PATHOLOGY OF PREGNANCY, LABOR, AND THE PUERPERIUM

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### CHAPTER XXVI

#### THE PATHOLOGY OF PREGNANCY

It would be surprising if a function which causes such marked general and local changes as gestation does should be completed without the production of conditions that might be considered pathologic. Pregnancy does not confer immunity against any disease; on the contrary, it makes the woman susceptible to certain general diseases, and almost always aggravates existing general, and especially local, affections. Only seldom do we hear that patients feel better during pregnancy: the majority suffer more or less discomfort. Many conditions formerly classed as normal are now called pathologic.

The affections of pregnancy are broadly divided into those of the mother and those of the ovum. Of diseases of the mother, two grand divisions are made—the *general* and the *local*, the latter taking in all the affections of the uterus, decidua, vagina, etc. Both general and local diseases may be classified, first, as to whether they are only morbid exaggerations of conditions natural to normal pregnancy—that is, they are incidental to pregnancy, are disorders of pregnancy; and, second, as to whether the diseases are accidental complications, either preëxistent or developed during pregnancy. The general diseases *incident* to pregnancy are most likely to be disorders of those functions most concerned by gestation, for example, the general metabolism, the liver and kidneys, the blood. Examples of *accidental* diseases are smallpox, tuberculosis, and syphilis.

Local diseases *incident* to pregnancy manifest themselves in pathologic increase of the congestion of the parts, abnormal tissue growth, deformation of the uterus, displacements, unusual location of the ovum, etc. Of diseases of the ovum, we must consider those of the child and those of the fetal envelops, the chorion, the amnion, the placenta.

Most of the diseases of the mother and child have close relations—one can hardly be ill without affecting the other. A great many general diseases have local manifestations in the genitalia, and many diseases accidental to pregnancy aggravate the affections incidental to pregnancy. The reader may thus appreciate the difficulties of making a classification of them and adhering to it in the subsequent discussion of the subjects.

#### CLASSIFICATION—PATHOLOGY OF PREGNANCY

**Diseases of the Mother Incidental to Pregnancy.**—*General.*—Toxemia; hyperemesis gravidarum; ptyalism; gingivitis; eclampsia; the kidney of pregnancy; acute yellow atrophy of the liver; chorea, blood affections; skin diseases, such as pruritus, fibroma molluscum, herpes gestationis, impetigo herpetiformis.

*Local.*—Varicosities; relaxation and softening of the pelvic joints; extra-



pregnancy; angular pregnancy; retroflexion of the gravid uterus; ante-  
flexion of the uterus; abortion; abruptio placentæ; placenta prævia.

**Diseases of the Mother Accidental to Pregnancy.**—*General.*—The exanthemas, scarlatina, typhoid, etc.; sepsis; syphilis; diseases of the lungs—sepsis, pneumonia, etc.; of the heart; of the kidneys; of the liver; traumatism.  
*Local.*—Deformities of the uterus; the local inflammations—vulvitis, vaginitis, endometritis, peritonitis, gonorrhea; tumors, as fibroids, carcinoma, cysts.

**Diseases of the Ovum.**—*The Child.*—Monsters (teratology); disorders of the kind which affect the child; the injuries of the fetus.

**Membranes.**—Hydatidiform mole; polyhydramnion; oligohydramnion.

**Placenta.**—Abnormal shape, size, and number; the white infarct; syphilis; calcification.

Finally, in a work of this size it will be impossible to treat fully all the above, nor will the scheme here given be strictly followed. Diseases duplicated under different headings will be considered together—for example, syphilis of the mother, of the child, of the placenta, and of the decidua will be treated as one subject. The author also considers it best to treat consecutively in a single chapter a disease which affects all three states—pregnancy, labor, and the puerperium—rather than to discuss it, as it influences each stage separately, in three different parts of the

## CHAPTER XXVII

### THE TOXEMIAS OF PREGNANCY

TOXEMIA is a term which has obtained very general usage, though little is positively known about the conditions it represents. It means that the blood contains toxins or poisons of an alkaloidal nature, leukomains, or substances similar to these. These toxins are supposed to be the result of deficient or abnormal general metabolism, or morbid processes occurring in special organs, as the liver, the kidneys, the thyroid; again, the poisons are supposed to come from the fetus or the placenta, from abnormal chemism occurring here. As a result of the deficient action of some organs of the body, for example, the liver, the kidneys, the thyroid, and perhaps others of the ductless glands, these poisons are retained in the body, or they are not sufficiently oxidized or changed so as to be rendered harmless and eliminable by the emunctories. The element of acidosis must also be considered.

Such is the theory, and to explain why and how these changes originate we have other theories. Many authors believe that every pregnancy is attended by an auto-intoxication, due to the mighty changes in the general metabolism incident to the condition, the active chemism required for the transfer of materials for the growth of the fetus, the presence in the maternal blood of the waste of the child, the by-products of the exaggerated eliminative action of the special organs, liver, kidneys, spleen, etc.

The constitution of a perfectly healthy woman might meet all these demands without any external symptoms or signs of disease, but such individuals are very rare, and, therefore, evidences of impaired function, of toxemia, are quite common. Abderhalden has shown that ferments capable of digesting placenta albumin in vitro are present in the blood of gravid women. Curiously, these ferments are weak or absent in toxemias. We may assume, therefore, with a degree of assurance, that some toxemias are explainable by the presence of unreduced albumen of ovular origin. The field thus opened by Abderhalden is very broad and promising. Predisposing elements for toxemia are neurasthenia, anemia, vicious heredity, especially one of toxic neuroses, antecedent liver, kidney, thyroid, intestinal, or other organic disease. Insufficient internal secretion by the ovary has been cited as a cause. Intestinal auto-intoxication is generally admitted, and perhaps the liver here is at fault, not arresting nor elaborating the absorbed poisons as it should.

Veit says the transportation and dissolution of syncytial elements of the placenta produce syncytio-toxins, which, if not properly met by antibodies in the patient's blood, act injuriously. *vide supra*, Abderhalden.

Experiments by Engelman and Fränkel have shown that the placenta contains thrombogenic ferments which are rapidly fatal to rabbits, but that when these are neutralized by hirudin (leech extract), the juice of the placenta is non-poisonous.

Bacterial action is also said to cause the toxemia—plausible, but lacks proof. Albert believes that endometritis, infective in origin, produces toxins which, absorbed, may cause toxemia, hyperemesis, and even eclampsia. Some cases seem to favor belief in this theory.

The name of Bouchard is most often associated with these studies on autointoxication. He has done a great deal of work on the subject. He sought to prove a relation between the city of the blood and of the urine—deficient excretion showing increase in the former. Into which filtered urine of pregnant women was injected had convulsions and died, autopsied the same conditions observed in the human. Later experiments disproved these assumptions. Pinard and Bouffe de St. Blaise ascribed the symptoms to a hepatotoxemia.

We have as yet very few scientific facts on which to base all these hypotheses, but, while desirable for practice, it is not unconditionally necessary to

ory proved. The general applicability is sometimes proof itself. We recognize many groups of symptoms which can be most satisfactorily explained by this theory of toxemia, and treatment directed in appropriate lines is successful in relieving the conditions. Some of the affections bear resemblance to certain phenomena explained as being anaphylactic.

**Symptomatology.**—Two groups of symptoms may be distinguished—the mild and the severe, but transition forms are common.

As mild toxemias, many of the minor complaints of pregnancy may be classed.

**The Nervous System.**—Headache, dizziness, hyperexcitability, lassitude, tendency to melancholia, exaggeration of reflexes, muscular twitchings, cramps in muscles, neuralgias, neuritis, aberrations of the special senses, as of taste (pica), of sight (strabismic vision), and of smell.

**The Skin.**—Edema, pruritus, pigmentation, various eruptions, for example, pes, pruriginoid lesions, acne, red nose. Graver symptoms will be considered later.

**Digestive Canal.**—Nausea, vomiting, constipation, colic.

**Circulatory System.**—Palpitations, syncope, varices, enlarged thyroid, symptoms resembling “formes frustes” of Basedow’s disease, anemias.

**Respiratory System.**—Cough, asthmatic attacks.

**Bones.**—The puerperal osteophytes, softening of the bones, similar to osteomalacia, pains in the bones, perhaps due to alteration in the hematopoietic system (?).

**The Urinary System.**—The kidney of pregnancy (Leyden), albuminuria, glycosuria, decreased urea output.

General examination of the patients will usually show the evidences of deficient nutrition, pasty or muddy skin, even subicterus, with perhaps an odor; dry, coated tongue, reddened gums, *pulse of low tension*, tympany, tender liver, and other findings. The pathologic anatomy of these toxemias has never been studied because they are not fatal. The severer toxemias have been much investigated, and we may deduce from such findings the probable conditions in the milder forms.

The treatment of mild toxemias is symptomatic and general, directed toward an increase of elimination, restriction of nitrogenous food, and hygienic living. Prevention of the graver toxemias, the hint of which is contained in the milder manifestations, is important. If the history, family or personal, points to such tendency, closer supervision of the gravida is needed. The consistent examination of the urine throughout pregnancy and the watchfulness over the patient, fully described under the Hygiene of Pregnancy, will disclose threatening dangers if the rules laid down for the guidance of pregnant women have not prevented such a course altogether.

The graver toxemias of pregnancy are hyperemesis gravidarum, eclampsia, hepatic autolysis (fulminant toxemia), impetigo herpetiformis, etc.

### HYPEREMESIS GRAVIDARUM

Nausea and vomiting occur, in greater or less degree, in half of all pregnant women, and are considered normal. They may be so marked as to become serious and deserve the appellation “pernicious,” leading not seldom to abortion or death, in both. It is difficult, in a given case, to tell when the vomiting passes from the normal to the pathologic. The disease has been called the obstinate, the uncontrollable, the incoercible, vomiting of pregnancy, but the term hyperemesis gravidarum, though a hybrid, is the one generally used. Soranus, of Ephesus (20 A. D.), observed the disease, but Delorme, in the 19th century, called attention to the danger of the affection. Simmond,

in 1813, was the first to interrupt pregnancy as a therapeutic measure, and with success. Paul Dubois, in 1852, before the French Academy of Medicine, presented a thesis on the subject which is still classic. It is said that Charlotte Brontë died of this affection.

**Symptoms.**—The disease usually begins in the second, more rarely in the fourth, month, but may appear in the sixth month, though seldom after this, and if it does, one suspects nephritis. It lasts from six weeks to three months, but may take so violent a course as to be fatal in two weeks. It may also intermit for a few weeks, then recur, growing better, then worse.

Dubois distinguished three periods in the sickness, and while clinically the lines of separation are never sharp, such a division of symptoms is useful for purposes of description. At first attention is not called to the gravida because nausea and vomiting are such frequent occurrences in the early months, but when the intolerance of the stomach for all liquids and foods becomes apparent and the patient loses her appetite, one is forced to recognize that the state of the gravida is serious. The anorexia may become an actual loathing of food, and nausea, with retching, may occur at the mere mention or sight or smell of it. Emesis is caused by a mere change of position of the person, the entry of another one into the room, even by the sight of the husband. It continues during the night, robbing the distressed woman of sleep, and contributing to the exhaustion caused by the constant retching. Hiccup may be a troublesome symptom, as may pyrosis. Thirst is harassing. The patient complains of a constant boring pain in the stomach and of soreness of the ribs and adjoining muscles. Salivation is occasionally a concomitant, even double parotitis; constipation is the rule, but sometimes there is diarrhea.

The vomit at first is composed of undigested food, mucus, and a little bile, later of mucus and bile; finally, it becomes bloody, bright, or of coffee-ground consistence. In one of the writer's cases the odor was almost fecal. The reverse peristalsis may be so active that medicines and food given per enema may be detected in the vomit. The blood may come from the mouth, pharynx, or stomach, and carries significance only if from the last. The urine is scanty, high colored, contains albumin, casts, sometimes blood, bile, acetone, diacetic acid, indican, and even sugar. It may also show the diazo-reaction. The urea is usually high, even 4 per cent., but Williams believes that in such cases a large part of the nitrogen excretion is in the form of ammonia. According to Losee and van Slyke there is but slight acidosis in toxemia.

During the *second stage* the symptoms become aggravated, and everything is rejected by the stomach; the patient complains of intolerable thirst, is extremely irritable and weak, has frequent fainting spells, and loses weight rapidly—in severe cases, as much as a pound a day.

**Examination** shows the skin pale, waxy, sometimes icteric, non-resilient, **shrunken**, the patient emaciated (only in the chronic cases; the toxemic cases may **re** emaciation is pronounced). The heart and lungs usually are normal, the **is rapid**—100 to 140, weak, "the pulse of empty arteries," the blood-pressure—the abdomen is scaphoid; one can trace the aorta from the epigastrium **its** bifurcation; great tenderness is elicited over the cardia and sometimes **liver**. The irritating vomit has eroded the lips and lower face; the gums **ed** and covered with sordes; the tongue is red, dry, brown in the middle, **ed**, sometimes to bleeding; the pharynx is dry, red, sometimes infiltrated **te** hemorrhages; the breath is fetid, and may have a penetrating or a **odor**. Fever of a low grade, but continuous, is now determinable, and **referable** to the nervous system usher in the third stage. Korsakoff's **as** been observed. In some cases the temperature remains subnormal **efore** death, when there is an agonal rise. Dehydration of the blood **is** shown by the hyperglobulism, both reds and whites, and, **may** indicate the time for terminating the pregnancy (Devraigne).

**P. F. Williams** in two cases found no increase of the non-protein nitrogen in the blood.

**Third Stage.**—Mental aberration, delirium, headache, somnolence, stupor, and coma occur invariably. The vomiting usually ceases, leading the attendants to raise false hopes, but the pulse increases in frequency, the general prostration rapidly augments, and the patient dies under the clinical picture of uncontrollable vomiting and acute starvation.

The length of the three stages varies very much—the first is long; the second, longer; the third is usually short, the patient rapidly going down, and herein lies a warning—not to let the disease progress to the third stage, because then even therapeutic abortion cannot stay it; on the contrary, the interference may hasten the end. The disease lasts from four to twelve weeks, usually six weeks, but it may be acutely fatal in ten to fourteen days. The latter cases are of the toxemic variety.

During all this disturbance, local and general, the fetus is usually alive, and if delivered at term, may be large and fat. If the vomiting is toxemic, the fetus is more likely to suffer, and abortion is more apt to occur. The vomiting often ceases on the death of the fetus.

**Causation.**—Curiously, more cases of this affection are reported from the United States and France than from Germany and England. Carl Braun, in an experience of over 150,000 obstetric cases, never observed one of hyperemesis that was fatal, but McClintock was able, with a very moderate amount of search, to collect 50 fatal cases. It is more frequent and fatal in multiparæ than in primiparæ. In the author's 30 cases, 15 were multiparæ, and of Rosenthal's 100 cases, only 33 were primiparæ. In discussing the cause of hyperemesis, one must not lose sight of the generally increased nervous excitability of pregnancy, which would tend to exaggerate the action of any irritant located at any part of the body. Uncontrollable vomiting is more common in neurotic, neurasthenic, and hysteric women, but it is particularly likely to develop if there is some irritant which may act on the stomach via the nervous system or blood. A study of my cases of hyperemesis and of milder gastric disturbances shows four more or less distinct classes: (1) Those in which the vomiting is a reflex from the genitalia; (2) when it is due to some disease of the stomach, some abdominal disorder, or abnormal condition of the blood; (3) where the nervous system is at fault; (4) where the general metabolism is disturbed, the clinical picture being that of a toxemia.

1. The reflex theory of hyperemesis explains some cases, and appropriate treatment often is curative. Owing to the close nervous connections between the genitalia and stomach by way of the sympathetic and vagus, reflexes through this arc are easy, as many common examples show. Examples of peripheral irritants capable of causing the vomiting are excessive distention of the uterus (Bretonneau), the ovum growing more rapidly than the organ can bear, as in metritis, polyhydramnion, hydatid mole, twins, displacement of the uterus (Grailly-Hewitt), acute anteversions and retroversions and flexions, the nerves being pinched or stretched; under this heading may be placed inflammations of the uterus, metritis, endometritis (Veit), tumors of the uterus, diseases of the adnexa, pelvic connective tissue, and peritoneum; peritoneal adhesions to the uterus; chronic cervicitis, with or without erosions (Bennett). The plausibility of this cause is shown by the good effect of treatment, since often when the pathogeny is corrected the vomiting disappears. In Hirsch's case a simple hematometra caused hyperemesis. Without doubt a special predisposition on the part of the gravida must be assumed to explain the excessive gastric reaction to the irritant, because such diseases of the genitalia often exist in marked degree without causing vomiting. It may be that a general toxemia sensitizes the vomiting center.

2. Where no lesion of the genitalia is discoverable, but other disease, usually

attended by vomiting, is present, pregnancy added to the condition may make the vomiting pernicious. Such diseases are gastric ulcer, carcinoma, chronic gastritis, enteritis, helminthiasis, large fecal concretions, enteroptosis, tubercular peritonitis, gall-stones, appendicitis; in fact, many intra-abdominal disorders. Nasal disease, hypertrophied turbinates, septal spurs, apical and laryngeal tuberculosis, anemia, chlorosis, all these have been invoked, and in occasional instances proved causative. If not actually causative, they may act as predisposition. Uremia from kidney disease may cause vomiting, but usually in the last months of pregnancy.

3. The nervous system may be at fault, either with demonstrable disease, as brain softening, locomotor ataxia, tubercle or other tumors, meningitis, polyneuritis,—but this may be an effect of toxemia,—or as the result of functional disturbances. Hyperemesis is not rare in hysterics, but in all probability most cases may be explained as a neurosis, a view prominently placed by Kalténbach. Ahlfeld and Oliver explain the vomiting as a cerebral circulatory disturbance similar to sea-sickness. Much may be said in favor of Kalténbach's contention, *e. g.*, the frequent occurrence of the disease in neurotic women, the good effects of suggestive treatment, and it is more than possible that a neurotic element is the basal cause of the vomiting in all the conditions mentioned under this heading. Treatment of a displaced uterus or of a diseased cervix, for example, simply relieves the patient of the peripheral irritant, but the vomiting ceases because the mobile nervous system comes again into equilibrium. In the absence of actual local disease, pure suggestion may cure vomiting in these neurotic cases, examples of which are the ice-bag of Chapman, a blister applied to the spine, absolute seclusion in a dark room, electricity, some drugs. A neurotic constitution is usually inherited from parents similarly afflicted, or such as are alcoholic, insane, or debilitated. Unusual stress of life may develop it, and pregnancy itself may do so. If a woman dies from neurotic vomiting, the course of the disease is very chronic, and the clinical picture and pathologic findings are those of starvation.

4. Toxemia best explains a large number of cases of hyperemesis, and the clinical picture as well as the pathogeny seems to show that there is a distinct disease entity. The changes in the liver, kidneys, stomach and blood, and the findings in the urine cannot be satisfactorily explained by assuming a starvation and dehydration. A noxa is in the system, either introduced from without or developed by abnormal metabolism within. Dirmoser believed that an intestinal auto-intoxication causes the vomiting, a view which is supported by some cases in practice. Charpentier relates a case where the excessive vomiting ceased on the opening of a peri-urethral abscess, and Goldspohn one where the removal of a fetid placenta from the uterus effected a cure, both suggesting the idea of an infection.

Toxins derived from the solution of syncytium, syncytiotoxin, are believed by Veit and others to cause hyperemesis, the blood not furnishing enough antitoxin to neutralize them. Recently injections of the serum of healthy gravidæ have been used as a curative measure—*i. e.*, to supply the deficient antibodies to the patient's blood (Mayer, 1911). The thyroid gland, the adrenals, the hypophysis, defective corpus luteum, have all been proposed as causes of the disturbed metabolism (Fieux).

Toxemic vomiting cases pursue a more rapid course, without much emaciation, and death results not from starvation, but from the profound alterations of the general metabolism.

**Pathologic Anatomy.**—At autopsy on women dead of hyperemesis gravidarum the most marked changes are found in the liver and kidneys. The liver may be slightly enlarged in the acute stages, but after the degeneration has progressed somewhat it is smaller. There may be a diffuse hemorrhagic hepatitis, with all the findings of acute yellow atrophy. There may be fatty degeneration of only the cells around the central lobular veins, or extensive areas of necrosis (Fig. 336).

**Thromboses** may occur in branches of the portal vein. Bile stasis is the rule. Hofbauer says the glycogen is limited to the periphery of the lobule. Pinard claims that slight changes of this kind are constant in pregnancy, and we should speak of the liver of pregnancy as well as of the kidney of pregnancy.

The kidney suffers all the changes from those of the so-called kidney of pregnancy to an acute parenchymatous nephritis. Fig. 338 shows a marked fatty degeneration of the epithelium of the secreting tubules. The glomeruli are, if at all, but little affected. Hemorrhages are often found, and possibly the degeneration may never be fully corrected.

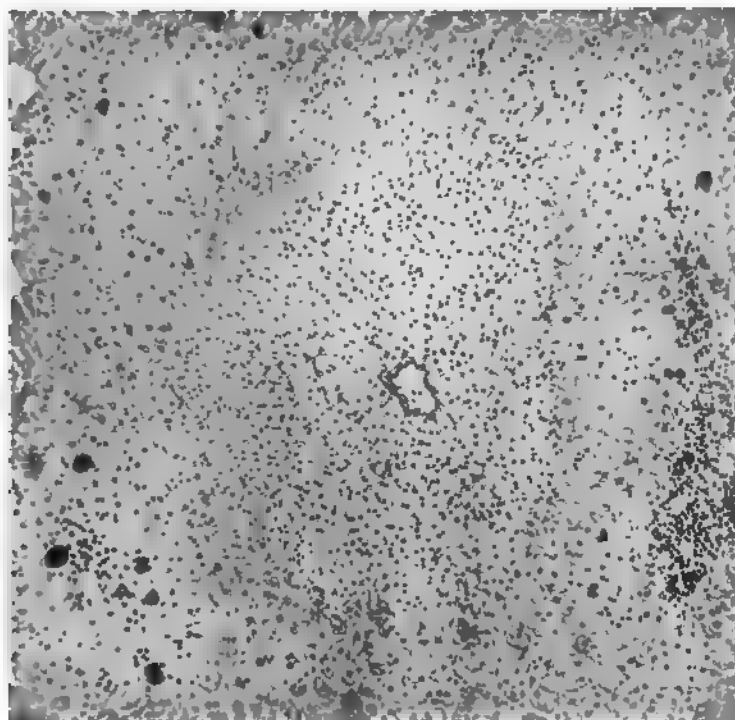


FIG. 336.—LOBULE OF LIVER IN HYPEREMESIS (low power).

The heart undergoes fatty degeneration in the bad cases, as in sepsis. The nerves also are quickly attacked by the circulating toxins.

**Diagnosis.**—First one must decide when the vomiting becomes serious enough to be called pernicious. When the stomach rejects everything; when the anorexia is complete and the general health is palpably affected, one must conclude that the so-called physiologic vomiting has passed over into the pathologic. As Guéniot has shown, the diagnosis is not so simple as appears at first glance. It consists—(a) Of the diagnosis of pregnancy, which is not so easy in the first trimester, when the cases usually present themselves; (b) in determining the causes of the vomiting, basal and adjuvant; (c) the differentiation of vomiting due to, or rendered pernicious by, pregnancy, from vomiting having no connection with an existing pregnancy, such as would occur in the absence of pregnancy. The diagnosis of pregnancy is made by the usual methods, and, owing to the emaciation, bimanual examination is rendered easier. A careful study of the genital findings will often lead to the discovery of a malposition of the uterus or other pelvic anomaly which may be the adjuvant cause of the excessive vomiting—that is, the peripheral irritant. Stomach, intestinal, hepatic, hemic, nervous diseases will require the

careful general medical investigation which should be a part of the treatment in all cases. An underlying neurosis is not always lightly assumed.

Of vital importance is the separation of the neurotic from the toxic vomiting. Whereas many kinds of treatment, especially suggestive, will cure the former, toxic vomiting is very rebellious and often requires the termination of pregnancy to save the woman's life. Rapidity of the onset of threatening symptoms, evidences of profound alteration of metabolism, such as jaundice, fever, prostration, with cerebral symptoms, marked acidosis, early albuminuria, casts, or blood, indican, much acetone and diacetic acid, tenderness over the liver, or bloody vomit, indicate a toxemia, while the more gradual development of the latter symptoms leads one to suspect a reflex or neurotic cause for the vomiting.

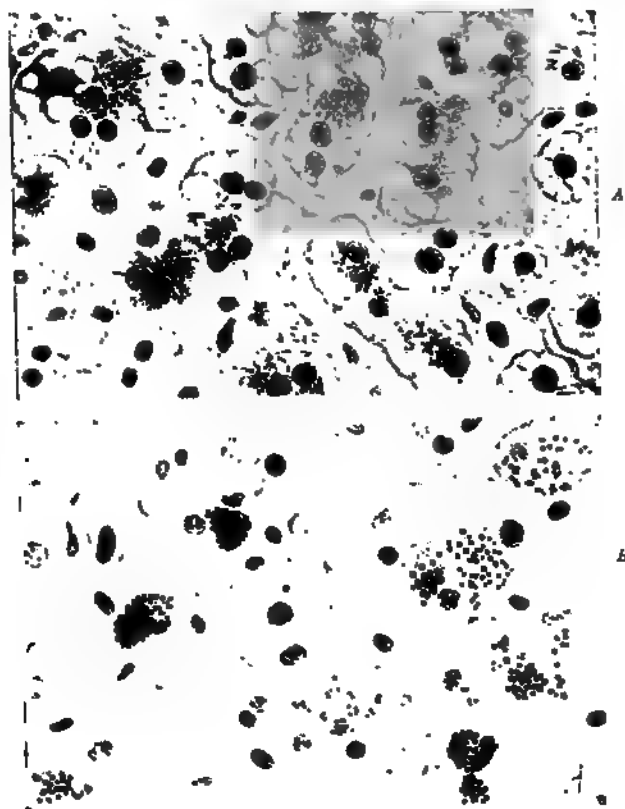


FIG. 337.—LIVER CELLS IN HYPEREMESIS (high power).

A, Cells in center of lobule, showing fat (yellow pigment) and crystals—tyrosin. \* Hektoen. B, Cells at periphery of lobule, showing granular protoplasm, pale nuclei, and blood-pigment.

Urinary findings are unreliable. Williams formerly believed that high ammonia, even to 40 per cent., with low urea-nitrogen output in the urine, indicated a toxic form of hyperemesis, but later investigations have shown that the high ammonia only means an acidosis, the result of starvation. A low ammonia content indicates a non-toxic cause of the vomiting (Williams), and may be the differential diagnosis between the two conditions. (See Murlin and I.

That the diagnosis is not simple is proved by the mistake made by Trueta, where, after induction of abortion for hyperemesis, the autopsy showed disease of the stomach, and one by Cascaux, where a woman dead from supposed vomiting of pregnancy had tubercular peritonitis, and the one of Beau, where a tubercular meningitis caused the death. W. E. Morgan, of Chicago, relates the case of



most in extremis from vomiting, threw up a ball of cotton which she had used for the purpose of inducing abortion. Prompt recovery ensued.

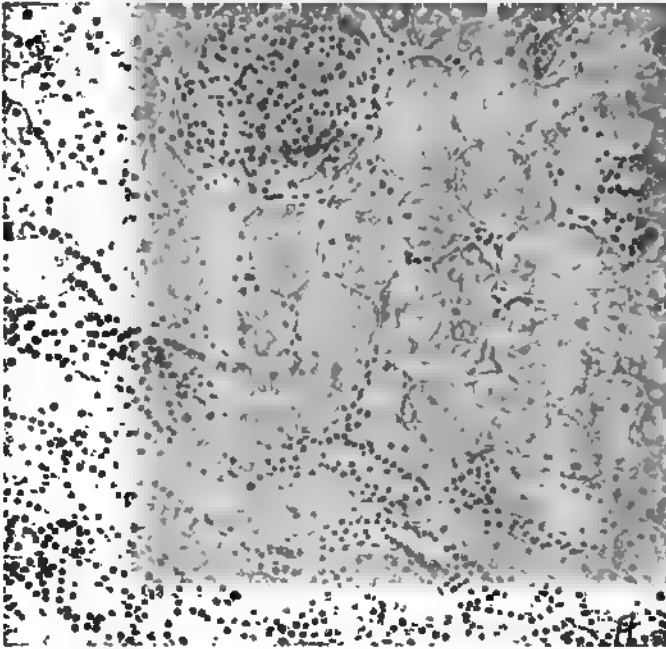


FIG. 338.—KIDNEY IN HYPEREMESIS (low power).

he premises are made very broad, the patient submitted to a thorough and physical examination, and sufficient time spent on the consideration findings, a good working diagnosis can usually be made.

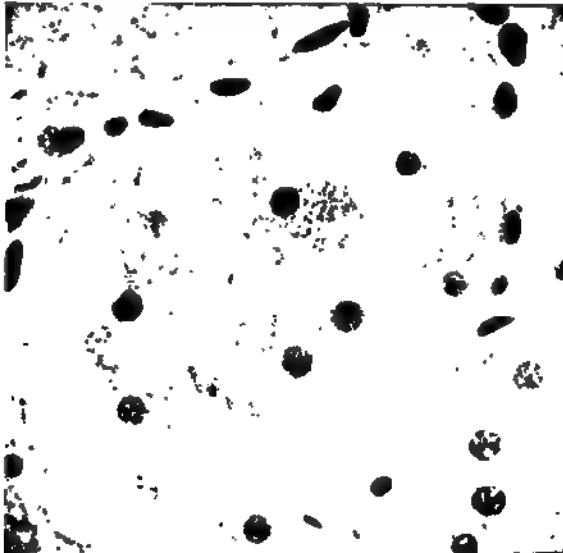


FIG. 339.—KIDNEY CELLS IN HYPEREMESIS (high power).

gnosis.—Guèniot collected 118 cases, with 46 deaths. Statistics are un- because the ideas of observers as to what constitutes hyperemesis differ.

Carl Braun, in an immense experience, never saw a death from the vomiting, which is a remarkable statement, because they do occur. The disease lasts ten days to three months, depending on the variety. Not seldom, either because of some attempt at treatment or spontaneously, the patient suddenly ceases to vomit, demands food and retains it, going on to rapid recovery—this, too, when the previous condition was such as to excite real alarm. More often the disease subsides slowly, or may not be fully cured until after delivery. If the fetus dies or abortion occurs, recovery usually begins, but not invariably, and, too, such an occurrence is rare, the course of the gestation being seldom affected by the general disturbance. If therapeutic abortion is delayed too long, it cannot prevent death, rather may precipitate the impending fatal exhaustion. The toxemic hyperemesis is less amenable to treatment than the reflex or neurotic varieties, but those cases where some pathologic condition of the stomach, brain, kidneys, or liver is aggravated by the pregnancy are most fatal. Death comes from acute starvation, acute toxemia, with delirium and coma, exhaustion, which may come on suddenly during apparent improvement, from rupture of stomach or bowel because of the constant retching, from hematemesis, and from intercurrent disease. Hyperemesis may recur in subsequent pregnancies. The toxemic varieties are usually more severe when they recur, the others less.

**Treatment.**—Careful search having revealed the cause, treatment is to be pursued along the lines indicated. The most important point to determine is whether or not the vomiting is toxemic. Since the exact cause is not invariably determinable, one may have to follow empiricism.

**General.**—Every mild case of vomiting during pregnancy should be cured as soon as possible with a view to preventing an aggravation of the disease. Attention to the bowels, a plain, easily digestible dietary, a gastric sedative, *e. g.*, cerium oxalate combined with scale pepsin, of each 5 grains thrice daily after eating, and suggestive therapeutics usually suffice to make the gravida comfortable. If water disagrees, Vichy may be tried. Cognizance may be taken of the capricious appetites of pregnant women, and the bizarre "longings" may be satisfied when the desired food is digestible. Dewees roused the patient early, gave hot coffee and crackers, and then had her lie in bed an hour or so, a plan that is often successful. Coitus is to be forbidden, the wife being best given a separate room. The knee-chest position for ten minutes three times a day, allowing air to enter the vagina, is often helpful. Dyspepsia or symptoms of gastric disease are to be treated on general medical lines, and it is wise to search for and correct all abdominal conditions found to be causative of hyperemesis. Recently the author by appendectomy cured the vomiting.

As soon as a given case shows itself to be obstinate and threatening, the woman should be put to bed, isolated as far as possible, and a thoroughly competent nurse put in attendance. It is best to remove the patient to a hospital. The room should be darkened (ocular disturbance sometimes causes vomiting), and the horizontal position consequentially insisted upon, even while taking food. In one chronic case much relief was obtained by the patient living on an open porch. The bowels must be emptied thoroughly.

The patient then is gotten quickly under the influence of bromids, 3j being given per rectum in 3iv of milk every four hours. Food is withheld for a whole day, rectal feeding being instituted. A pint of 2 per cent. glucose solution is given with every alternate bromid enema. Underhill emphasizes the need of carbohydrates. One quart of Locke's solution is administered under the breasts. When food is given it should be dry—buttered toast, a dry chop or sliver of chicken, crackers with jelly or marmalade. Water may not be drunk before one and a half hours after eating nor one hour before the next feeding. If dry diet is rejected, liquids or semisolids are tried, failing which, rectal feeding is instituted. Water in large

amounts must be gotten into the system, and sugar too. At the same time measures are undertaken to reduce any existing acidosis. The above treatment has seldom failed the author, and the failures were in the severe toxicemic cases.

*Suggestion* forms a large part of the treatment of cases of pernicious vomiting, and without doubt many of the measures here advocated depend on it for their success. The physician should determine if the woman is suffering from a neurosis, and then institute a course of treatment with a view to impressing her with his power to cure her. How this is to be done depends on individual circumstances.

*Medical.*—There is no specific for this disease, as the host of remedies used with apparent success and disheartening failure testifies.

1. *Local Anesthetics.*—Cocain hydrochlorid,  $\frac{1}{8}$  grain in 1 ounce of water (has little influence on the bad nausea and vomiting, but may help to retain some food for a while); menthol,  $\frac{1}{8}$  to  $\frac{1}{2}$  grain in water; volatile oils—peppermint, wintergreen—in small doses. Cracked ice swallowed whole may relieve thirst.

2. *Mechanical Drugs.*—Bismuth, cerium oxalate, soda-mint tablets, milk of magnesia, etc., may be tried. Digestive ferments do not act so well as in the non-pregnant state, but pepsin and ingluvin may be tried, and when chronic gastritis or atonic dyspeptic symptoms appear, tincture of nux vomica and hydrochloric acid, especially if an alcoholic basis is suspected. Usually, as the disease gets worse, drugs are more harmful than good.

3. *Depressomotors.*—Sodium bromid may be given in 60-grain doses by rectum, and morphin,  $\frac{1}{4}$  grain hypodermically, for temporary relief. The effect is apparent, but morphin may later increase the nausea. A hypodermic of morphin may be given just after the feeding and it may serve to retain the meal. In some cases of centric vomiting, alcohol, in the form of dry champagne or brandy, served in cracked ice, has a good effect. If it is retained, we may go on with other food.

4. *External Remedies.*—Ether spray and pressure on the stomach; warm flannel band or adhesive straps around the stomach, tightly; fly-blister to epigastrium; Chapman's ice-bag (a long cylindric ice-bag) to the spine, or a blister to the fifth or sixth cervical spine. Electricity is of little value, but may be used as a suggestion. The galvanic current or electric radiation of the epigastrium may be employed.

Kaltenbach has warmly recommended washing out the stomach. In certain hysteric cases it does great good, and in gastroptosis and gastritis may also be useful. It is not to be used if the patient is too weak, as it is depressing, or if a gastric ulcer is suspected.

5. Disease of the nasopharynx is to be treated. Temporary relief is occasionally obtained by spraying the nares with 4 per cent. solution of cocain, or inhaling smelling salts.

6. *Salt solution*, 0.7 per cent., injected subcutaneously, is a valuable addition to our means for meeting the loss of body fluids from the constant vomiting. A quart may be injected every day or a pint several times a day, preferably Locke's solution, which contains calcium.

The extremities may be wrapped in wet towels, and inunctions of oil or lard used, some of these being absorbed. Bed-sores must be assiduously prevented.

The latest remedies for hyperemesis are suprarenal extract, proposed by Rebaudi in 1909, and the serum of healthy pregnant women, recommended by Freund in 1909 and by Mayer in 1911. I have used adrenalin many times, with success in half of the cases. Twenty drops of the 1:1000 solution are given three times a day by mouth, or five drops hypodermically. I have used dry placenta, corpus luteum, by mouth and hypodermically, with both success and failure,—being convinced that their action is not specific, but only through suggestion. Three cases improved under the use of serum from a healthy gravida, and three did likewise under hypophysis injections. (Suggestion?) Under the belief that the system needs calcium, I have always used Locke's solution hypodermically.

*Gynecologic Treatment.*—The patient should be examined carefully with the aid of a speculum, and anything abnormal remedied if possible.

An anteverted or a retroverted uterus is replaced—in the knee-chest position, if necessary—and a pessary inserted. In one of the writer's cases, the wife of a colleague, an acutely anteverted uterus was raised with a balloon pessary, with immediate cessation of pronounced nausea and vomiting. Owing to a pin-hole defect in the bag, the air slowly escaped and the symptoms gradually returned, to disappear permanently when a perfect instrument was substituted, thus proving that the effect was not due to suggestion.

An erosion of the cervix is treated with 10 per cent. solution of silver nitrate—indeed, the method should be employed on empiric grounds even if the cervix exhibits no alteration. After irrigation of the vagina with sterile water a small Ferguson speculum is introduced and the cervix engaged in its end. The silver solution is poured in and allowed to remain five to ten minutes until the tissues are whitened, then washed out with 1 per cent. salt solution. After two days the treat-

ment may be repeated. Its rationale is not understood, but it is often efficacious, and Carl Braun used it as a routine practice. Bennett, the inventor, used carbolic acid and iodine. M. O. Jones, of Chicago, recommended the silver, but J. Marion Sims drew general attention to the remedy. In one case where the silver applications failed the author employed Bier's suction treatment applied to the cervix. The woman was in desperate condition, and abortion was to be the next procedure, but recovery ensued and the pregnancy went to term. How much the local treatment contributed to the result is uncertain. Copeman, of Norwich, in 1875, in a case of hyperemesis, tried to induce abortion by dilating the cervix with his finger, but failed; his patient, however, ceased to vomit. Subsequently, dilatation of the cervix became a recognized method of treatment, to be employed before abortion was induced, as a *next to the last* resort. The author has never used it.

**Obstetric.**—Therapeutic abortion will cure all cases of hyperemesis if done early enough. It will cure all cases of neurotic or reflex vomiting unless the patient is too near death from starvation and exhaustion to withstand the operation. Toxic vomiting, being an expression of a profound systemic alteration of the metabolism, does not respond so quickly, because the organs, especially the liver, may have been too much damaged by the poisons circulating in the blood. Williams' advice, therefore, to empty the uterus as soon as the vomiting is pronounced toxic, deserves serious consideration, though one may not always follow it. In the first place, a positive diagnosis of toxemia cannot always be made, and, too, many cases of toxic vomiting recover under the usual treatment.

The delicate point to determine is *when to empty the uterus*, and the general appearance of the patient must decide it. Hofbauer says that if glycosuria results after the ingestion of 2 ounces of levulose, a test of the glycolytic power of the organ, the time is at hand, because this proves that the liver is already attacked by toxins and has begun to suffer. Examination of the blood, showing intense concentration (hypererythrocytosis and leukocytosis), may indicate the degree of starvation. Pinard says that when the pulse remains above 100 one should not delay the operation, especially if the blood-pressure sinks at the same time, and many accoucheurs interfere on the appearance of fever, hematemesis, jaundice, albuminuria, mellituria, acetonuria, indicanuria, the diazo-reaction, or marked loss of weight. Few hold that polyneuritis with icterus and the appearance of bile-pigment in the urine indicate abortion. Not one but all these facts must be considered, together with one's clinical experience. The progress of the case, the condition of the patient, and the effect of treatment—these will indicate the time to interrupt pregnancy. The disease is so treacherous that it is better to interfere earlier rather than too late, because often many remedies are tried in succession, using up much time, and then, when the uterus finally has to be emptied, the patient is in no condition to stand the shock of operation. Consultation must always be had, first, to verify the diagnosis and the necessity of performing abortion; second, to protect the attendant from the imputation of criminal operation, and, third, to share responsibility. All appearance of secrecy is to be avoided, the operation being performed in a hospital, if possible. In early cases the best way is to dilate and curet the uterus in one sitting. Later in pregnancy it may be better to dilate the uterus, insert gauze, and complete the operation the next day. When great haste is demanded, anterior vaginal hysterotomy is the operation of choice. Freund, in three cases, with much ado pretended to perform abortion and thus cured the vomiting. One could try this drastic mode of suggestive therapeutics when the hyperemesis is due to a neurosis.

Hyperemesis is sometimes feigned so as to mislead the accoucheur into performing an abortion. The patient will exaggerate her symptoms and falsify statements. In all cases the objective signs only should be relied upon.

Literature on hyperemesis gravidarum is to be found in article by Ingraham, Jour. Amer. Med. Assoc., 1912, page 28.

## PTYALISM

Salivation is a rare complication of pregnancy. It is related to hyperemesis in that it is probably caused reflexly. Hippocrates noted it in pregnancy. It is to be distinguished from the "cotton spitting" described by Dewees as one of the signs of pregnancy.

Salivation combined with nausea and vomiting frequently occurs, but may occur alone. It usually begins in the second month, and ceases about the fifth or at quickening, presenting the same variations as the vomiting. It almost always ceases with parturition, but has continued for a few weeks thereafter. It usually occurs but once, but may appear in successive pregnancies, and may be absent in one and recur in the next. The flow varies in amount, excessive quantities being reported—over two quarts a day. It usually lessens during the night, but may continue unabated. The saliva is very watery, tasteless, odorless, limpid, not acid; it has little ptyalin. The patient cannot swallow it: it nauseates.

The drain of this large amount of fluid, the absence of digestive power, and the loss of appetite not seldom compromise the nutrition of the patient, and a condition of exhaustion resembling that produced by incoercible vomiting has proved an indication for terminating the pregnancy in these cases (rare). There are few changes in the mouth or gums. The salivary glands may be a little swollen and tender; the tongue is coated, with red edges; and sometimes a gastric catarrh exists. The patients feel miserable, are always thirsty, have difficulty in talking, and the chin may be excoriated.

Ptyalism has the same causation as hyperemesis, and occurs most often in neurotic women. It may be a familial characteristic.

The diagnosis is easy, since mercurial salivation is attended by fetor and stomatitis. Montgomery says that ptyalism may be a symptom of hysteria and of cancer of the uterus.

The treatment is pursued along the same lines as in hyperemesis. Of the many drugs used, sodium bromid is the best—30 grains thrice daily. Pilocarpin is less efficient, and atropin is useless and dangerous. Adrenalin and pituitrin should be given a trial. In two cases a pint of Locke's solution injected under the breast on alternate days worked a cure.

## GINGIVITIS

The slight tumefaction and hyperemia of the gums so often observed in pregnancy (50 to 60 per cent.) may be aggravated to a severe affection. Sponginess of the gums, hemorrhage into them and from them, even loosening and dropping of the teeth, occur. There is no fetor, no salivation, and there is usually little pain in the parts, though mastication is difficult. There is no periodontitis in typical cases.

Redness of the gingival margins and hypertrophy are visible, and sometimes polypoid excrescences of varying size, which are subject to ulceration, appear between the teeth. The region of the molars is less affected.

Gingivitis affects primiparæ and multiparæ alike, but is more common in those who neglect the teeth and person and in women of poor health. It begins about the fourth month, disappears after delivery, but may even appear in and be aggravated by lactation. It may recur in each pregnancy. Its causation is obscure. Perhaps the altered buccal secretions play a rôle, or the altered metabolism of pregnancy (toxemia?). Such alterations in the secretions may favor the growth of bacteria which, in turn, cause caries. The treatment is hygienic; antiseptic mouth-washes, as tincture of myrrh in water, potassium chlorate, 1 ounce in 1 pint of water, weak peroxid solution, milk of magnesia, cleansing the gums with a soft cloth, rub-

bing precipitated chalk into the crevices, and iron and calcium tonics, combined with outdoor living. Hemorrhage from the gums is treated by a compress of gelatin or of adrenalin, or cauterization. Polypoid excrescences may be removed a few weeks postpartum if they do not shrink up.

Toothache is a not infrequent occurrence in pregnancy, and it is especially troublesome in women subject to neuralgia. Carious teeth, also common, should be cared for during gestation; even extraction under gas should, if indicated, be made, but exhausting gold fillings had better be postponed, temporary cement or inlays being inserted. The gravida should be given a tonic of lime and hypophosphites.

### ECLAMPSIA AND ALLIED CONDITIONS

One of the most dangerous complications that may befall the pregnant woman is convulsions attended by coma. Naturally, a gravida may suffer from the convulsive seizures to which any woman is liable, such as epilepsy, hysteria, meningitis, etc., but there is a symptom-complex presented by pregnant women, of which convulsions are the most prominent manifestation, to which the term "eclampsia parturientium" is applied. There are several varieties of symptom-groups or syndromes, some pointing to the liver as the main seat of the trouble, others pointing to the kidneys, others to both. Again, the convulsions may be absent, the condition being one of failure of one or the other organ. Under this heading would come the kidney of pregnancy and acute yellow atrophy of the liver, because the first often leads to convulsions, and the other is not seldom a terminal condition of eclampsia.

It is impossible to classify these diseases because the causes are unknown. They all could be grouped under one head, toxicoses or toxemia, if it were known that an intoxication of the blood really lies at the base, but this theory, while generally believed, and indeed very plausible, is not positively proved. One would then speak of a nephritic toxemia, a hepatic toxemia, cerebral toxemia, depending on which organ is most affected by the circulating poison, or whose symptoms dominated the clinical picture or postmortem findings. At present we group all cases of convulsions and coma occurring in pregnant women, not due to extraneous medical causes, as hysteria, epilepsy, tubercle of the brain, etc., under the term eclampsia. Those rare cases where the woman has all the symptoms of eclampsia without convulsions we call eclampsia just the same. Some writers refer to them as "acute toxemia." The kidney of pregnancy is generally held to be due to a pre-eclamptic toxemia of very mild degree. The nephritis of pregnancy is the next step in the gradation to the real nephritic form of eclampsia. The liver is always involved either primarily or secondarily, and some cases of eclampsia seem to be due entirely to hepatic inefficiency, the renal changes being secondary, and such cases are likely to terminate under the clinical picture of acute yellow atrophy of the liver, presenting the classic autopsy findings.

**History.**—Hippocrates mentions convulsions of pregnant women and knew that they most often occurred in women who had headache and a tendency to sleep (coma). The word eclampsia means to flash, or shine out, and was introduced by Boissier de Savages in 1760 and Gehler in 1776. More properly it should be *eclactisma* (Kossman).

**Clinical Course.**—*Prodromata.*—The eclamptic attack may occur suddenly without warning, but this is not the rule—almost always there are premonitory symptoms, so that, with ordinary care, the accoucheur is not taken unawares. These symptoms are headache, dizziness, a tendency to nervous excitation or to sleep, occasionally slight mental unbalance, twitchings in the muscles, cramps in the calves, *usea*, vomiting, *pain in the epigastrium*, and disturbances of the special senses—*ts* before the eyes—*muscæ volitantes*—bright lights, sometimes colored, some-

imes described as spangles, dimness of vision, hemianopsia, even complete blindness, due to edema or retinitis and sometimes with hemorrhages, photophobia; ringing in the ears, even deafness, and occasionally anomalies of taste and smell. These may be manifestations of peripheral or of central lesions. Prodromata are present from a few hours to several weeks before the actual outbreak, and serve to draw attention to the condition of the patient.

These warnings should be heeded and an exhaustive examination of the patient made. This will usually show edema of the feet and eyelids, or more or less marked general anasarca, with pasty skin, a coated tongue, fetid breath, tenderness over the pit of the stomach (the site of the pain) and over the liver, *high pulse tension* with accentuated second heart-sound (the blood-pressure may reach 240), intensely exaggerated reflexes, diminished urine, high specific gravity, albumin with hyaline and granular casts, and low urea output. Occasionally the urinary findings are negative, but there is marked edema, high blood-pressure, with or without symptoms, and sometimes even edema fails, but marked subjective manifestations are present. Rarely one observes a slight subicterus. These symptoms may be called those of *preëclampsia toxemia*, the *eclampsisme* of the French, and a patient presenting them may be said to be threatened with convulsions.

*The Attack.*—Wherever the patient may be, she falls to the ground unconscious. The pupils dilate, the eyes are turned, and the head also, to one side; the patient opens her mouth, then the jaw is pulled laterally, and there may be a cry or a sigh. The whole body becomes rigid; the features are distorted; the arms flexed; hands clinched; the feet inverted; the toes flexed, and the whole person drawn to one side in a tonic spasm. This condition lasts for a few seconds, then the jaws open and close violently, the eyelids also, the twitchings beginning in the face, then usually one arm, then the leg, and now the whole body. This is a violent clonic convulsion, which may throw the patient out of the bed against any object. Severe injuries can result—even fractures of the skull or long bones; the tongue is protruded; the teeth may chop it up. Foam, often tinged with blood, comes from the mouth. The respiration is completely stopped, the chest being rigid. The pulse is high and strong; later it grows weaker, but may be hard to feel because of the convulsion. In rare cases the pulse is weak and the arterial tension low from the start, a fact which is explained by degenerative changes in the heart. The blood-shot eyes protrude, the face is swollen, the cyanosis is extreme, the lips are purple—altogether the picture is a horrible one. Gradually the convulsive movements remit, a few twitches or jerks take place, the patient lies quiet, the heart thumping violently against the chest-wall. For a few seconds the woman appears to be dying, but there is a long sigh, and stertorous breathing becomes established, coma supervening. Soon the respirations quiet down. In the favorable cases the patient wakes up after a short time bewildered, severely sore in all the muscles. After from a few minutes to an hour another fit occurs, or she may have no more. With recurring convulsions the intervals become shorter and the patient lies in deep coma all the time. Fever now begins; the pulse-rate rises. The fits may occur every five minutes, but usually the time is twenty minutes to one hour, and they may show some regularity of recurrence. Cases are on record of 81 (recovery) and even 104 convulsions (Olshausen). These cases almost invariably die. The average number is from 5 to 15 attacks. The convulsion lasts from thirty seconds to two minutes, very rarely any longer, and these are bad cases. Between the attacks the patient may be quiet or restless, and sometimes there is great jactitation, with wild and exhaustive delirium. These cases usually show signs of severe liver involvement.

Marked albuminuria with casts—hyaline, epithelial, granular—and blood are the rule in true eclampsia; reduction of the amount of urine is constant and occasionally there is anuria. Cases of eclampsia without albuminuria are due to apoplexy,

ver is usually present and a slight jaundice is seldom absent, the blood-pressure is very low, and such cases are characterized by great asthenia. Marked liver colic is usually found at autopsy, but death may have been too quick for much change in the kidneys.

**Nephritic Eclampsia.**—Women with chronic nephritis seldom have convulsions in pregnancy and labor, but they suffer from other complications—anasarca, uremia (usually coma), pulmonary edema, cardiac paralysis, retinitis albuminurica, cerebral hemorrhage, then with convulsions, premature labor, abruptio placentæ. Convulsions do occur in chronic nephritis, and then it is hard, but usually possible, to make the differential diagnosis.

Acute nephritis is more easily developed in a pregnant woman because the kidneys are carrying an increased burden, and, too, are often diseased through the pregnancy changes (the kidney of pregnancy, Leyden), and when it does occur, convulsions almost always result. An apparently healthy gravida, suddenly, after exposure to cold, after a flagrant error of diet (a Christmas dinner, for example),

following an angina, develops an acute nephritis with convulsions. These cases are the ones which occur without much warning, and may surprise the most painstaking accoucheur, and clinically they cannot be differentiated from true eclampsia.

**Causation.**—Eclampsia occurs once in about 600 pregnancies, but this varies in different statistics and in different localities. The cause of this variation is unknown. Primiparæ are oftener (3 to 1) affected than multiparæ. It generally appears in the last three months of pregnancy, but may occur as early as the tenth week (author's case). Fatal cases are reported in the third, fourth, and fifth months. Thaler collected 12 cases of eclampsia in the first months. In about 20 per cent. of the cases the convulsions begin during pregnancy; in 60 per cent. during labor, and in 20 per cent. after delivery. Schröder had 62, 190, and 64 cases respectively. Predisposing causes are primiparity, especially in advanced years, excessive nervous irritability, previous disease of the kidneys or liver (scarlatina or other infectious disease), heredity (Elliott reports a case where a mother and four daughters died of eclampsia), twin pregnancy, contracted pelvis, infantilism.

In spite of the enormous amount of study that has been put upon it, the real cause of the disease is unknown. The theory that has most plausibility is that of a toxemia—some noxa circulating in the blood which produces necrosis of the liver, and, directly or indirectly, degenerative changes of the kidneys and also convulsions, by direct toxic action on the anterior cerebral cortex.

Where do these toxins originate? Many theories have been advanced. Halbertsma believed that the uterus, by compressing the ureters, produced thus a urinemia. This is disproved by the majority of eclamptics by postmortem examination, as it occurs in less than 10 per cent. of the cases. Delore suggested that bacteria might be the cause of the toxemia. Various bacteria are found in the blood and the placenta by Doléris, Blanc, and Favre. Gerdes found a bacillus which Hofmeister proved to be the common proteus, and Gley found the *Staphylococcus aureus* and *albus*. The frequency of sepsis after eclampsia, the febrile nature of the disease, the fact that it may follow an attack of tonsillitis, that it occurs oftener in cold and damp weather, would argue for an extraneous microbic origin. Acute sepsis sometimes terminates under the clinical picture of acute yellow atrophy of the liver, which brings it a step nearer to eclampsia. Stroganov states that eclampsia is an acute infectious disease introduced through the lungs. Many cases of previously healthy women, who, after a few days of prodromal symptoms, develop eclampsia, tend to make such a hypothesis very probable. However, up to the present no one has been able to isolate a germ that could be considered causative. Albert and Müller believe that the infection is in the genitals and the toxins produced there, as from an endometritis, are absorbed and cause the convulsions.

That diet has something to do with the causation of eclampsia seems to be proved by the facts. Fats and animal protein are almost eliminated from the diet of German women, and the incidence of eclampsia has declined more than 50 per cent. (Warnekros). Stoeckel questions this.

Bouchard, in 1887, broke new ground when, in his "*Leçons sur les Auto-intoxications*," he advanced the theory that eclampsia results from the accumulation of retained waste, which the excretories failed to get rid of. His pupil, Rivière, believed that an overproduction of toxins occurred during pregnancy; that this was favored by hyperemia of the kidneys and liver, and that these poisons damaged the kidneys. He sought to prove these theories by determining the toxicity



of the blood and urine in the eclamptic and non-eclamptic gravida. Other authors, Vollhard, Schumacher, and Stewart, disproved these theories.

Then the liver was accused. Pinard and Bouffe de Saint-Blaise, argued that eclampsia was a hepatotoxemia due to liver insufficiency. Ahlfeld and Schmorl have found, in cases of typical eclampsia, pathologic conditions which strongly resemble those of acute yellow atrophy of the liver.

Lange believed that the thyroid gland has much to do with eclampsia, and by administering iodothylin he cured the albuminuria of the kidney of pregnancy. Nicholson and others have obtained favorable results with thyroid extract, but the theory has not awakened general interest. That eclampsia may be due to the disturbance of balance between the organs with internal secretions which should neutralize each other is an attractive but absolutely unproved hypothesis. The parathyroids (Vassale) have been suggested, the ovaries (Pinard), the corpus luteum, and the mamma—Sellheim (on the theory that eclampsia is similar to parturient paresis in cattle, which is cured by treatment directed to the mammae), but not yet the hypophysis cerebri. The theory of Veit, the deportation and solution of syncytium, without the production of sufficient antisyncytitoxin, remains still a theory. The Abderhalden pregnancy test is weak or negative in eclampsia. The significance of this fact is unknown.

Numerous investigators have tried to find a toxin in the placenta, but Frankl, in summing up their efforts and his own, decides that there are no toxins in the placenta, but that there may be ferments, and says that this line of study will more likely lead to useful results. (See also Holland.) Eclampsia has been held a form of anaphylaxis due to the introduction of a foreign protein, and several facts render such a theory plausible.

It has long been observed that the blood of eclamptics contains an excess of fibrin (Dienst). This is probably not the cause of the disease, but is one of the effects of the common cause. The same may be said of the high arterial tension usually found early in the disease.

The idea that the child and placenta may be the origin of the toxins is not new. Ahlfeld mentioned it in 1894, and Fehling and Collman support this view. The author has delivered diseased children from eclamptic mothers, and entertains no doubt but that the fetus can sicken independently of the mother and secondarily infect her, or after delivery continue ill and die. It is more than probable that certain cases of eclampsia without albuminuria and other evidences of renal disease, and cases of nephritis or toxemia developing without warning in previously healthy women, may be found to be due to a diseased ovum. Bouffe de Saint-Blaise in 1888 saw a case of eclampsia in a molar pregnancy. Hitschman saw another in a girl pregnant four and one-half months with a hydatid mole. These may be confirmatory of the above, or they may mean that a live fetus is not necessary for the production of the convulsions. Eclampsia may occur with a macerated fetus, though usually the child dies as the result of the toxemia, and then the condition of the mother improves. Poisons excreted by the fetus reach the general circulation without passing through the liver, and perhaps these unoxidized excreta irritate the kidneys, which are not able to throw them off in this state. Changes identical with those found in the eclamptic mother have been found in the fetus also dead of convulsions (Bar, Knapp, Dienst, and DeLee). Zweifel has found sarcolactic acid in the urine of 17 eclamptics, in the blood, and in the fetal blood. It was absent from the urine of a case of pure uremia, but present in the blood of all children born dead and in all the placentæ examined. These experiments are in line with the newer theories of acid intoxication. Zweifel has not proved that the lactic acidemia is the cause of eclampsia—only that the lactic acid is present in the urine of eclamptics. This finding occurs also in cases of asphyxia, dyspnea, exhaustion from severe physical effort, some febrile conditions, and poisoning by morphin, curare, strychnin, veratrin, cocain, phosphorus, etc.

Since Rayer and Lever (1843) proved the presence of albumin in the urine of eclamptics, and later students found the indications of a nephritis almost invariably in the urine, the idea gained ground that eclampsia was allied to uremia. Carl Braun said the convulsions were due to acute renal insufficiency. While at autopsy, or in the urine, one will rarely miss evidences of nephritis (Ingerslev and Charpentier have found 250 cases in the literature without them), still the weight of clinical and postmortem evidence is against the view that kidney disease is the cause of eclampsia. It is more likely a result of the action of another cause, and is secondary, not primary.

Studies of the maternal metabolism show that there is an alteration in nitrogenous catabolism. It has long been known that there is a decrease of the total urea output, but recent studies by Whitney and Williams show that the amount of ammonia nitrogen equals or even exceeds the urea nitrogen in the urine. It is possible that study of the metabolism will lead us to a solution of the problem, but nothing of great value has yet been discovered. P. F. Williams found the non-protein nitrogen in the blood increased but little, and not in proportion to the severity of the convulsions.

Ammonium carbonate (Spiegelberg), carbamic acid (Ludwig and Savor), or leukomains (Massen) circulating in the blood are mere theories. It would lead us too far to go deeper into this mass of hypotheses.

The theory that eclampsia is due to an intoxication, is a toxemia, is most generally accepted, while it is admitted that the source and the nature of the poisons are unknown. If we knew whether the toxins came from the liver, the fetus, the placenta, the intestines, the general metabolism, disturbed glandular balance, from bacterial activity or from any other source, it would help our treatment immensely, but as yet we are groping blindly, empirically.

**The Cause of the Convulsion.**—Here again there is much room for speculation. Without doubt the nervous system of the pregnant woman is in a state of hyperexcitability. This may easily be determined by testing the exaggerated reflexes. Perhaps this is another result of the toxemia of pregnancy. Older writers classed eclampsia as a neurosis (Dubois), and, in fact, it is more common in neurotic women. Dührssen explains the convulsions as being due to a spasm of the blood-vessels of the brain, the liver, or the kidneys, from an irritation proceeding from the uterus.

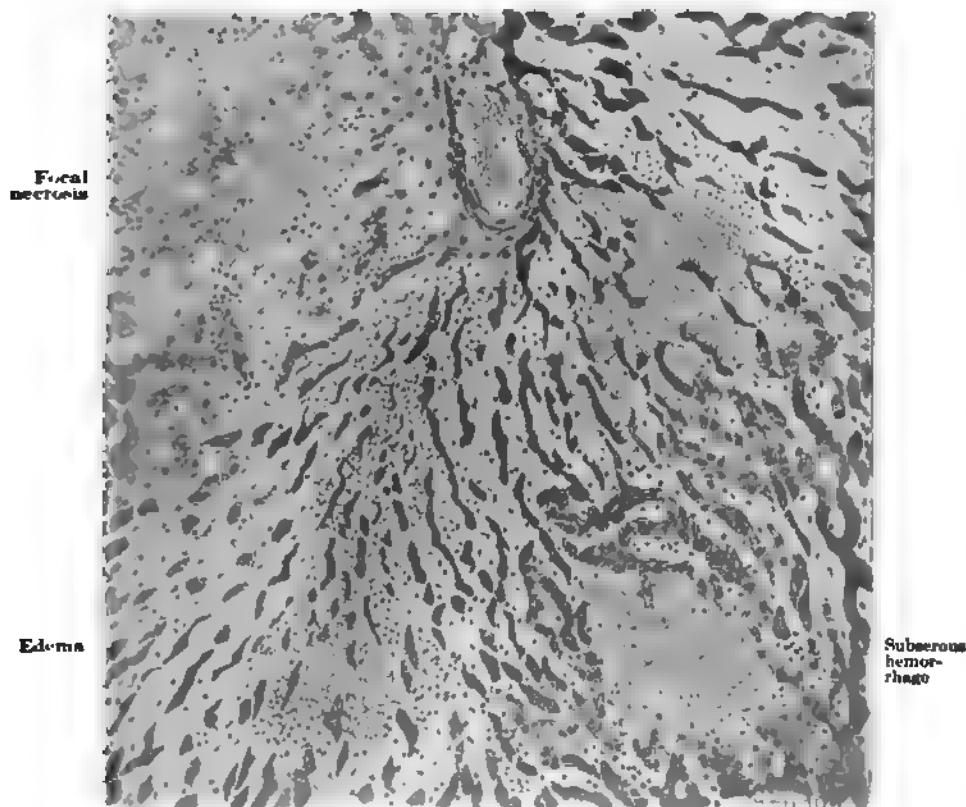


FIG. 340.—ECLAMPTIC'S LIVER.

Spasm of the vessels of the brain causing acute anemia and edema may cause the fits, and analogy is drawn from cases of epilepsy. One need not go far for an explanation of the convulsions if the toxemic theory is proved, —the toxins irritate the nerve-centers, as do other specific poisons, strychnin, tetanus, etc.,—but the toxin of eclampsia has a special affinity for the cortex of the forepart of the brain, as is shown by the constancy of convulsions and coma and the mental symptoms. Individual convulsions in a case of eclampsia may be elicited by any external irritant, for example, jarring of the bed, slamming of doors, bright lights, external or internal examination, the induction of labor, a hypodermic injection, an enema, catheterization, delivery of fetus, etc. Zangemeister defends the theory that increased intracranial pressure causes the convulsions and all the symptoms, there being an edema of the brain similar to that occurring in other portions of the body—the legs, the eyelids, etc.—a very plausible theory and one that, if proved, would give us rational methods for treatment.

**Pathologic Anatomy.**—*Brain.*—Flattening and moderate edema of the convolutions, sometimes with anemia, sometimes with congestion. Small or large hemorrhages or areas of cerebral softening with thrombosis occurred in 58 of 65 autopsies (Schmorl). Apoplexy is not

uncommon, especially into the ventricles. In unusual cases other causes for the convulsions are found, as tubercle, tumors, meningitis, phosphorus-poisoning, etc.

*Liver.*—Here the most typical changes are found; indeed, one can almost make the diagnosis

from the liver at autopsy (Fig. 340). There is albuminoid degeneration with hemorrhage and anemic necroses. These focal necroses occur near the small portal vessels, which are often thrombotic (Fig. 341), and may be seen by the naked eye. In addition there is fatty degeneration of the periphery of the lobules, which may be so marked as to make the slide resemble one from a case of acute yellow atrophy of the liver, a fact pointed out by Jürgens, Stumpf, Ahlfeld, and others. There may be a general autolysis of the liver or only cloudy swelling. Hepatitis and perihepatitis hæmorrhagica are also occasionally found. These changes show how profoundly the liver is affected by the circulating poisons if the liver disease is not the primary trouble and the general eclamptic syndrome the result of acute hepatic insufficiency. (See Ewing.)

*Kidneys.*—Almost always some signs of disturbance are present. In 289 cases observed from 1892 to 1900 in the Berlin Charité there were symptoms referable to the kidneys in every

one, and changes were found in all that went to autopsy. Schmorl, in 73 autopsies, found only 1 with normal kidneys. A very severe congestion exists in some cases—often the signs of a more or less acute nephritis. Cloudy swelling and fatty degeneration of the epithelium are the rule. Thrombosis of the glomeruli and smaller veins and arteries are common. The kidney of pregnancy, with an acute inflammation, the so-called pregnancy nephritis,—occurs in a majority of cases, and this is hard to distinguish from acute parenchymatous nephritis. Degenerative changes are seldom missed, a fact which is usually easily discovered in the urine. Further, we find all forms of subacute and chronic Bright's disease. Swelling of the kidney so that it stretches its capsule is rare, as is shown at operations of decapsulation (Edebohls). Dilatation of the ureters is found occasionally, particularly the right, but has no significance. While renal changes are almost invariably found, most authors are convinced that they are secondary either to the general toxemia or to the disease of the liver.

*Circulation, Schmorl.*—The ventricles are usually contracted, the auricles full of dark blood which does not clot readily, contrary to the condition of hyperinosis which existed during life. The heart muscle is fatty, with tiny hemorrhages, necroses, and thrombi; it tears easily, and these changes may be a cause of death. Fatty heart is found espe-

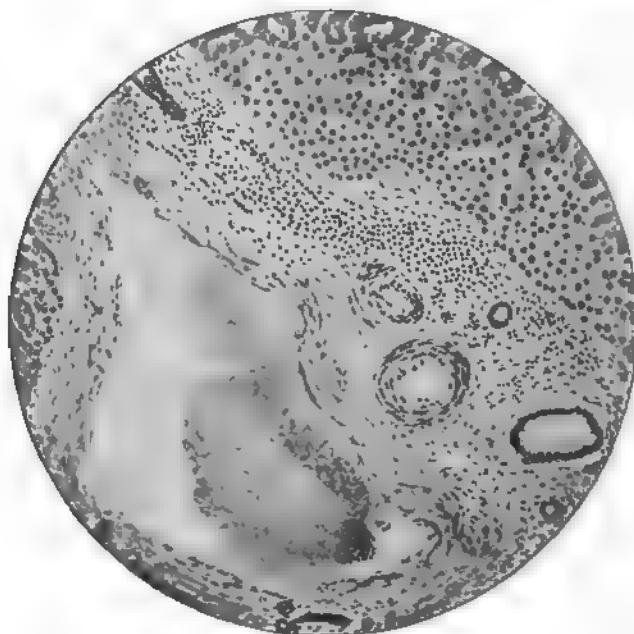


FIG. 341.—THROMBUS IN ECLAMPTIC LIVER.

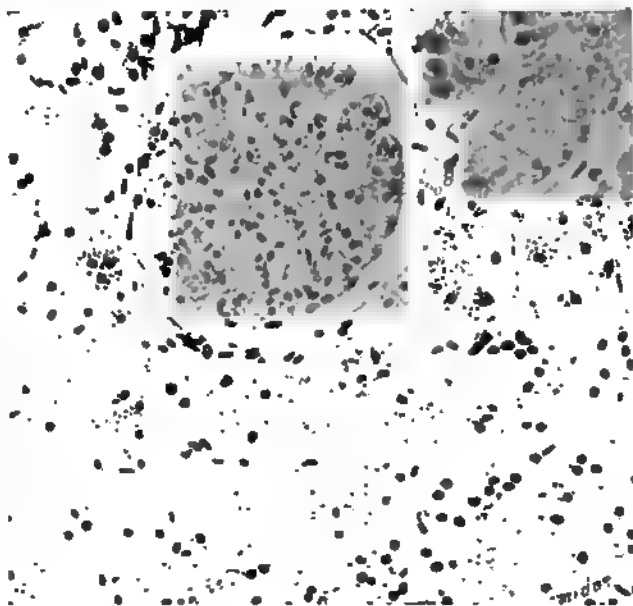


FIG. 342.—KIDNEY IN ECLAMPSIA.

ially in those cases which had been given large doses of chloroform and chloral, a fact which warns of care in the administration of these drugs. There may be subpericardial hemorrhages.

Thromboses and emboli in fine vessels are very common in the lungs, liver, kidneys, brain, and skin; they consist of liver-cells, endothelium, and syncytium. The last has no significance, being found in normal puerperæ. During life the blood contains an excess of fibrin and coagulates very quickly, so that often it is impossible to perform venesection properly. Microscopic findings of the blood in eclampsia are not constant. The reds are sometimes increased (in one instance to 1,000,000), which is due to the concentration of the blood, and there is marked leukocytosis (40,000), especially noted in the multinuclears.

*The Lungs.*—Almost always congestion and edema are found, and very often hemorrhages, which are usually under the pleuræ. Bronchopneumonia is not rarely found, due to admission of food-particles, blood, slime, etc., into the air-passages—*aspiration pneumonia*. Septic pneumonia, and, oftener in general hospitals, croupous pneumonia, may be the cause of death. Gangrene of the lung is sometimes the cause of death. Small arterial and venous thromboses and emboli of it, liver-cells, decidual cells, and cells that look like hypertrophied nuclei of lymphoid cells of the bone-marrow, that is, syncytium, are constant findings. These are not characteristic, occurring in other conditions.

*The Fetus.*—Bar and others have found changes in the child which correspond very closely with those in the mother, especially when the child died of convulsions.

**Diagnosis.**—Convulsions and coma during pregnancy may come from brain tumors, tubercle, apoplexy, meningitis, pneumonia, epilepsy, hysteria, phosphorus, strychnin and other poisonings, as by drugs taken to induce abortion, uremia, and true eclampsia. Characteristic for true eclampsia are repeated convulsions with coma, or at least lethargy, between them, early fever, and marked albuminuria, with other findings of renal involvement. The history of the case will almost always exclude poisoning, but medicolegally a differential diagnosis may occasionally be necessary, and this may not always be possible, even at autopsy, because, for example, the liver in cases of phosphorus death resembles acute yellow atrophy. Epilepsy is eliminated by the history of previous convulsions, but the first attack of a permanent neurosis may occur during labor, or, as occurred in a case of the author, epilepsy may be inaugurated by an attack of eclampsia, a fact which was also noted by Ferè. The contracted pupils and diminished or absent reflexes and low blood-pressure are good points in favor of epilepsy. Epileptic attacks seldom occur during pregnancy and labor, and are usually single, but the status epilepticus may cause trouble in making the differential diagnosis. Here the slight or absent urinary findings, the late presence of fever, diminished reflexes, and the history must help.

Hysteria will cause no trouble to an observer who has seen both conditions. An atypical convulsive seizure, lasting a long time, with grotesque motions and spastic contractions of muscle groups, retained consciousness, and mobile pupil, without cyanosis or stertorous respiration or fever, or urinary findings, serve to make the differentiation easy.

Organic disease of the brain must be diagnosed by the usual medical methods, but mistakes are very liable to occur in cases of meningitis, tubercle, and apoplexy. Spinal puncture may be required. The Wassermann reaction may not be used in differentiation because it has been found in 8 cases of true eclampsia by Semon. The treatment must be carried out on obstetric lines.

From uremia it is impossible to separate true eclampsia unless the preëxistence of nephritis is known, but often the general picture of the case impresses the observer as one of renal insufficiency, and, again, another case gives almost indubitable signs that the liver is at fault. Delirium, jactitation, jaundice, and petechiæ point to hepatic involvement. Treatment in all cases is the same.

**Prognosis.**—Over 20 per cent. of women afflicted with eclampsia die, and this has been hardly affected by changes of treatment in the last one hundred years. Wyder collected large statistics, and showed a general mortality of 20 per cent. and a mortality of 10 per cent. of cases which developed in the maternities. The prognosis varies in different countries, in different years, and to a certain extent with different operators. Statistics vary from 5.31 per cent. (Stroganov) to 45.7 per cent. (Büttner) for the mother, and from 3.62 to 42 per cent. for the child.

(See Peterson.) When attacked by true eclampsia multiparæ probably are no more endangered than primiparæ, but since renal disease is more common in them, the prognosis is usually worse when convulsions occur. Eclampsia occurring during pregnancy has the highest mortality, during labor less, and during the puerperium the least, but the experience of the individual observers may be otherwise, as in the author's cases the worst have been those where the attacks began postpartum.

For the child the chances are not good, nearly one-half of the children dying, a result that is due to—(1) Prematurity; (2) toxemia; (3) asphyxiation by the repeated convulsions of the mother, with prolonged cyanosis; (4) drugs (morphin, chloral) administered to the mother; (5) injuries sustained during birth, especially forced delivery. The child may die of eclampsia after delivery.

One must, therefore, in individual cases give a very guarded prognosis, even in the apparently favorable ones, because death may occur in coma after one or two convulsions. Death comes from exhaustion, heart failure, toxemia (the system being overwhelmed by the poison, such cases being evidenced by deep coma, with few or no convulsions), embolism, thrombosis of the pulmonary artery, fat embolism of the lungs, hemorrhage into the brain, pulmonary edema, œdema laryngis, and asphyxiation. Further, the patient is endangered by the results and accidents of severe operations undertaken to deliver her, as *ruptura uteri*, postpartum hemorrhage from cervix tear, from drugs administered, such as chloroform and veratrum, and from sepsis. Infection is a common cause of death, and eclamptics show a decided susceptibility to it.

In individual cases the pulse is the best index. If it remains full and hard, below 120, there is no immediate danger, but if faster, weak, compressible, or even running, with low blood-pressure, the prognosis is bad. A falling blood-pressure in the absence of hemorrhage or shock is of good omen. High fever is not necessarily a bad prognostic sign unless it runs above 104° F. and is going higher. Symptoms of edema of the lungs, rattling in the chest, bloody froth from the mouth and nose, with cyanosis, are usually precursors of death, but may respond to treatment. Prolonged and violent fits or frequently repeated attacks with short intervals, or both, give a bad outlook, but recovery has occurred after 81 attacks, though this is unusual. When the number exceeds 20, the prognosis gradually becomes worse. If the severity of the symptoms abates after delivery, the woman usually gets well. Rarely is there a recurrence of the fits after hours or days, and, if there is, recovery is the rule. Such cases are likely to show a large number of attacks, for example: Jardine, 207; Engelman, 200. It is doubtful if these were true eclampsia. Deep cyanosis between attacks is an unfavorable symptom, as also is extreme jactitation. Anuria and intense albuminuria are of bad omen, and more hope is justified as soon as the kidneys show signs of recovery. Apoplexy is almost always fatal, but sometimes part of the body will be paretic or paralyzed from a focal edema which disappears during convalescence.

After delivery the puerpera is not out of danger. Aspiration pneumonia is not rare, the result of mucus, blood, food, etc., being drawn into the lungs by the deep stertorous respiration. The tongue may be so severely bitten during the fits that it may become so swollen as to demand intubation or tracheotomy to prevent suffocation. Pneumonia, too, may result from the infected bitten tongue. Sepsis is common, and usually runs a severe course, since the kidneys and liver are already diseased. Late effects may be aphasia, amaurosis, hemiplegia, and puerperal insanity (1 out of 20, Loehlein).

After delivery the albumin quickly diminishes in amount, and may have been reduced to a trace by the time the puerpera leaves her bed, disappearing entirely in from three to twelve weeks. A longer persistence of the urinary findings indicates permanent damage to the kidney parenchyma, and one should be guarded in prognosis. In subsequent pregnancies albuminuria and casts may recur, even

convulsions (Dührssen, 1.5 per cent.), but we must decide that a chronic though latent nephritis has existed in the mean time. Many authors believe that one attack of eclampsia confers immunity, but such is not the case. Even the kidney of pregnancy may recur. It has been held that the kidney of pregnancy never left permanent changes in the organs. This statement can be neither questioned nor proved, because it is never possible to demonstrate absolutely that the woman did not carry into her pregnancy a latent nephritis, dating, perhaps, from a scarlatina or infection in infancy.

**Treatment.—Prevention.**—One can speak of rational prophylaxis only when the cause of disease is known. Since we do not know the cause of eclampsia, our treatment is all empiric. Even so, more can be accomplished by prevention than by treatment, because after the convulsions have set in the nervous balance is overthrown. We cannot prevent the action of the primary cause of the eclampsia, but by carefully watching the pregnant woman we may discover the first manifestations of the action of such noxious influences, and by appropriate measures either ward them off entirely or interrupt the pregnancy before the disease reaches a climax. It is the pregnancy that favors the development of eclampsia. If we cannot prevent and cure eclampsia, we can remove the pregnancy. If the earliest signs of the impending catastrophe can be detected, emptying the uterus will almost invariably prevent a fatal issue.

The prevention, in a general way, is equivalent to the conduct of the hygiene of pregnancy. Every pregnant woman should be considered a possible candidate for eclampsia, and all our efforts should be directed to save her. Greater watchfulness is imperative if the family history presages trouble, for example, if the mother had eclampsia, if the parents were neurasthenic, insane, or alcoholic, these indicating a hereditary instability of the nervous system which may lead to disorders of metabolism, especially during the crucial test of pregnancy. The personal history is important; for example, if the patient had eclampsia or declared renal disease before; if she has had diseases which may have damaged kidneys or liver, especially the acute infections; if she is of a "bilious type," one is on the lookout.

If, in spite of the hygienic rules laid down for the patient, the symptoms of toxemia appear, if the blood-pressure begins to rise, or if the urine—which should be examined as a routine duty every two weeks in the latter months of pregnancy—shows evidences of deficient renal activity, the patient is put on a strict prophylactic regimen. Albuminuria is the most important finding, and, in the author's experience, is never marked without toxemic symptoms. Diminished daily amount of urine and decrease of total solids are next in importance. Casts, unless granular and cellular, are not unusual in the urine, but they may not be numerous without exciting suspicion; white and red blood-corpuscles with renal epithelium show the acuteness of the process. The percentage of urea is not a reliable index of the nearness of the attack, but it is a valuable adjunct to the diagnosis, since when a woman passes less than half the amount of urea considered normal and has albuminuria, we can suspect derangement of the liver and kidneys. If the urea steadily diminishes while the albumin increases, the danger signs are unequivocal. In suspected cases weekly and even daily examinations of the urine are made. We now have in the sphygmomanometer a valuable aid in early detecting toxemias. A rising blood-pressure is a warning of danger, and the limit of safety may be placed at 150 mm. Although blood-pressure readings increase the work of the accoucheur, they must be taken as a routine in the latter months of pregnancy. As stated in the chapter on the Hygiene of Pregnancy, all gravidæ are requested to notify the physician if any untoward symptoms arise, and the accoucheur should give these women a large amount of personal attention, because the symptoms will show that trouble is brewing long before the urine discloses the fact.

When the first signs or symptoms of toxemia occur, treatment must be at once instituted. It will proceed along three lines: (1) The diet should be so ordered that just enough nitrogenous matter is given to sustain life, in the form easiest assimilated, and that will leave the least amount of waste and by-products, which throw extra work on the liver and kidneys. (2) The emunctories should be stimulated to throw off the surcharge of poisons already in the blood. (3) Should the above treatment not have the needful effect; should the evidences of renal insufficiency increase; or should the signs of a real nephritis appear, the induction of premature labor is not only justifiable, but imperatively indicated.

(1) In aggravated cases of toxemia, and when the kidney is involved in even a moderate degree, it is well at once to put the patient to bed and allow nothing but water to drink. After two days, when improvement is apparent, an absolute milk diet is ordered. The French are the most ardent supporters of this treatment, and in my hands it has given excellent results. As the condition improves starches are added to the diet, then the proteid vegetables, with the vegetable oils and butter. If the improvement is progressive, full vegetarian diet with the milder fruits and one egg a day may be allowed. Later a little fish, chicken, or turkey is added, but never a full meat diet. Spices, tea, coffee, alcoholics, beef, veal, mutton, and pork are strictly forbidden. Water is given in large amounts unless the heart is already overloaded. Buttermilk, matsohn, and kumis are recommended. My experience with a salt-free diet has been disappointing. The edema was somewhat lessened by it, but the condition of the patients was not materially improved.

(2) One may increase excretion by the bowels, the kidneys, the skin, and the lungs. A brisk saline purge is given at the start, and the bowels are kept open by salines, alternating with vegetable cathartics, since continuous administration of the former leads to anemia and headaches. Water is administered morning and night on an empty stomach. It is both laxative and diuretic. Diuresis is favored by the ingestion of liquids, especially hot water in large amounts. This, in combination with the milk diet, does not fail to produce polyuria. Buttermilk is also given, but the vegetable diuretics and diuretin are not recommended.

The author has discontinued the sweating treatment of toxemia and eclampsia, it being dangerous and inefficient. Werner and Kolisek having proved that the serum from edematous parts is more toxic than that of the general system, it would be illogical to sweat the patient and cause the absorption of these toxins. Jaborandi is heartily condemned, even when the patient is conscious, as it is dangerous and unnecessary. Of drugs, the author uses few. Hexamethylenamin, 10 grains four times daily, in three cases seemed to do good, but the author wishes more experience before recommending it. It was given on the bacterial theory of toxemia.

A valuable means for starting the skin and kidneys is the subdermal injection of Locke's solution. It is used only in the advanced cases, when eclampsia is threatening and quick action is needed. Fresh air in abundance aids excretion by the lungs, and the patient is instructed to fill and empty the lungs by very deep breaths in fresh air ten times each morning and evening. Shears recommends oxygen inhalations.

When treatment faithfully carried out on the lines here laid down has failed to produce sufficient amelioration of the symptoms, if the evidences of renal insufficiency persist or grow worse, if the blood-pressure steadily rises, and especially if a tendency to sleep, twitchings, or other symptoms of eclampsia threaten, the pregnancy should be terminated.

The symptoms that, in my opinion, most surely indicate the near approach of convulsions are: Headache, occipital or frontal; seeing colored lights or "span-gles"; amaurosis or changes in the retina seen with the ophthalmoscope; twitching of the muscles; somnolence or insomnia; nausea and vomiting; pain in the epigastrium; subicterus; general edema of the body; high blood-pressure (175 to 200, with 100 or more diastolic) and marked albuminuria. Rarely one or the other symptoms will stand out very prominently, or several may be absent. Marked leukocytosis is also significant, and in doubtful cases the permeability of the kidneys could be tested with the phenolsulphophthalein and other tests,\* though thus far the results are not of any great value.

How long one should wait to see the effects of treatment depends on the individual case and on the attendant's experience, but the final proof of our deep ignorance of the nature of these affections is brought by the fact that sometimes, when these patients go untreated, eclampsia does not occur, and when treatment has produced apparent cure, the convulsions occasionally manifest themselves, as in

\* Jour. Amer. Med. Assoc., Symposium of the June, 1912, Meeting.

ie case, where the patient had been in bed under medical treatment for six weeks, as successfully delivered, but three days postpartum convulsions developed and death ensued. Eclampsia is not always a preventable disease, as Davis and Ligar claim, a view which is supported by Williams. As yet we have no certain index of impending eclampsia—all we can say is that the gravida presents the syndrome of a disease in which convulsions are the usual termination, and that it is best to terminate the pregnancy, the ultimate cause of the disturbance.

**Methods.**—That method of inducing premature labor should be selected which will empty the uterus quickest and with least traumatism. The symptoms rarely are so threatening as to demand excessive haste. In multiparae the simple rupture of the membranes is usually sufficient, and comes on, as a rule, within twenty-four hours. In primiparae it is better to prepare the cervix by packing it and the lower uterine segment with gauze for from twelve to twenty hours. Contractions are elicited, the tissues softened, and the chances of injury to the cervix and danger to the fetus diminished. After removal of the gauze the membranes are punctured, the liquor amnii is allowed to drain off, and then a Colpeurynter is inserted, which evokes strong pains and completes the dilatation, so that when the bag is expelled the child soon follows. (See Induction of Labor.) After labor has been inaugurated it should be terminated as soon as the conditions will permit, as experience has shown that eclampsia is less likely to occur postpartum after a quick delivery. The pains seem to elicit convulsions in some cases, and if eclampsia is very imminent, it may be best to select an operation which empties the uterus in one sitting. (See page 378.)

**Treatment of Eclampsia.**—When the pregnant, parturient, or puerperal woman has had the first convulsion, the case at once assumes a most serious aspect. The nervous balance has been upset, the degree of saturation of the system by the noxa has grown too great, and one convulsion is likely to lead to another. The mortality of eclampsia is still from 20 to 45 per cent. for the mother and 30 to 60 per cent. for the child. Such high mortalities rarely accompany surgical complications, hence the patient deserves as much, if not more, consideration than does the surgical patient. She should have at least two physicians and one or more good obstetric nurses. If a good maternity hospital is near by, she should be quickly transported thither; if not, the facilities of the maternity should be closely imitated at home.

There are three general plans of treatment—two extremes and one occupying a middle position. Dührssen's dictum is—after the first convulsion put the patient into a deep sleep and deliver at once. The other extreme is, put the patient to bed, protect her from injury, light, and noise, give narcotics, chloral and morphin, stimulate the emunctories, bleed, etc., and await the natural termination of pregnancy and labor (Stroganoff). Those accoucheurs occupying the middle position use the medical treatment more or less, and hasten the labor only if the patient's condition is evidently going from bad to worse.

Experience is accumulating to prove that the rapid emptying of the uterus in deep narcosis after the first convulsion gives the best results. Carl Baum emphasized the fact that the convulsions ceased or became less severe after delivery. Dührssen showed that in 93.75 per cent. such a result was found, and Olshausen showed 85 per cent. Seitz and Reuben Peterson prove it conclusively in very large statistics. In the author's experience of 90 cases the patients did better after early delivery so far as the convulsions were concerned, and the proportion of actual recoveries was slightly increased. Statistics from large material, however, show decided improvement. Peterson, collecting 615 cases of early delivery (as soon as possible after the first convulsion), finds a mortality of 19.9 per cent., and compares this with 28.9 per cent., the mortality in the same maternities under so-called conservative treatment. Another table shows 4 per cent. and 31 per cent. respectively. R. Freund reports 551 cases of eclampsia from the Berlin Charité, which were delivered within one hour with a mortality of 0 per cent. Stoeckel (1917) limits his passing over to a more active method, especially with cesarean section. Another strong argument for early delivery is the larger number of children saved thereby, estimated by various authors as two and three times as many. Late



statistics with Stroganoff's method of treatment—morphin, chloral, etc.—are so good that it is to be recommended to the general practitioner working without the facilities of a well-equipped hospital.

*Methods.*—The method of effecting the delivery depends on, first, the period of pregnancy; second, the environment of the patient; third, the state of the cervix; fourth, the skill of the operator; fifth, extraneous complications, for example, contracted pelvis, placenta prævia, etc. Before the seventh month all children die, and it is, therefore, necessary to procure only enough dilatation of the cervix to perform craniotomy and extraction. After viability one must try to save the baby also.

If the cervix is fully dilated, delivery is accomplished at once by forceps if the head is engaged; by version and immediate extraction if the head is above the brim. The pains in eclampsia are usually strong, and rapidly efface and dilate the cervix. Indeed, one is sometimes surprised to find the child delivered under the coverlet.

If the cervix is effaced, shortened, taken up, so that only the thin edge remains, this may be dilated with the fingers, or with any of the metallic dilators on the market, or by means of hydrostatic bags, or the thin partition may be incised (Dührssen's incisions). Manual dilatation in these instances is the method of choice. After this, forceps or version and extraction of the child, depending on engagement.

If the cervix is tightly closed, not effaced, the cervical canal long, two methods of delivery are available—vaginal and abdominal cesarean section. In a primipara before the thirty-fourth week and in a multipara with softened, usually lacerated cervix, roomy vagina, and relaxed pelvic floor, vaginal anterior hysterotomy is indicated. In a primipara, at or near term, with a long, hard cervix and rigid soft parts, this operation is very difficult, and the question of abdominal cesarean section arises. It was proposed by Halbertsma in 1889, and while it saves most babies (90 per cent.), the maternal mortality is high (25.79 per cent., Peterson). The new cesarean section (page 1030) has a decidedly lower mortality and is preferable. If the patient has, besides eclampsia, a contracted pelvis, at the inlet or the outlet, even of minor degree, a large fetus, or one presenting unfavorably, placenta prævia, heart disease, etc., one will select the abdominal operation, and do it under local anesthesia with novocain, supplemented by N<sub>2</sub>O and oxygen. (See Conditions for Cesarean Section, page 1019.)

Unless either of these methods of delivery is practised, the first local interference to be made is the rupture of the bag of waters. In many cases this causes the convulsions to abate, but we usually go ahead with other means of effecting delivery, i. e., metreurysis.

Manual dilatation of the closed cervix is an operation requiring from one to three hours; it is always attended by laceration of the parts, which tears are very often deep, and not seldom fatal, either from hemorrhage or from extension through the uterus into the peritoneal cavity, or from infection, and is, therefore, condemned. The same statement applies to the use of Boes's and other metal dilators when the cervix is uneffaced.

Incisions into a closed cervix may not be made unless the typical vaginal cesarean section be performed.

Dilatation by bags, the colpeurynter of Carl Braun, the inelastic balloon of Champetier de Ribes, or its modification by Voorhees, can, in favorable cases (soft, dilatable cervix), be accomplished in one sitting under anesthesia, lasting one to two hours, but if the cervix is rigid, an attempt to force it open in this time would fail if it did not rupture the uterus. In such cases the patient must be put to bed and the action of labor-pains awaited. Only uterine action will soften, efface, and safely dilate a hard cervix. Unfortunately, rigid cervix is a frequent complication of eclampsia, since this condition is common in primipara and in those of advanced age.

Often after the bags have procured partial opening of the womb delivery may be effected by vaginal cesarean section. A rigid pelvic floor must not be overcome by brute force, since uncontrollable lacerations may result, and, too, the baby's head must not be used as the forcing wedge. Perineotomy should be done, the cut being a bold one, through the anterior or puborectal portion of the levator ani. (For further particulars see p. 318.)

During the delivery of eclamptics extraordinary precautions against sepsis must be observed, because they are particularly liable to infection, the kidneys and liver being thrown out of immunizing action. In spite of the most rigid precautions the author has seen fatal infection arise. One source of trouble is feces streaming from the anus, the result of the administration of cathartics and enemata before delivery. This danger is so great that the author withholds such practice until after the uterus is emptied. If the field of operation is constantly soiled by discharges from the rectum, the anus should be closed by a circular suture, which is to be removed just before the child is delivered.

The selection of the anesthetic requires careful thought. Chloroform, ether, and nitrous oxid all have a destructive action on the liver, kidneys, and blood, especially in toxic states. Chloroform is the worst and should never be used. In the sixties it was administered for long periods, once by Simpson for seventeen hours, but at autopsy in such cases fatty heart and acute yellow atrophy of the liver were frequent findings.

For cesarean section, local anesthesia with novocain, supplemented if need be with N<sub>2</sub>O and oxygen, will almost always suffice. For vaginal cesarean section one may also use local anesthesia, but usually ether is required. Paravertebral anesthesia is a new method and commendable. In general, ether is the choice where complete relaxation is needed, though several operators use N<sub>2</sub>O and oxygen. This, to be safe, must be given by an expert. Morphin and scopolamin are rarely useful. The rule should be to add as little as possible of poisons to an already toxic system.

hemorrhage during delivery, if moderate, is not to be checked too soon, since bleeding is one adjuvant means of cure.

Should the perineum be torn during spontaneous delivery, it may be wiser not to give anesthetic for its repair, but to leave it for future operation. If the tear occurs in operative delivery, especially if a complete one, it should be sutured—at least the sphincter should be united. The operator should not forget that eclamptics may suffer from shock, as Bailey has pointed out. Frequent blood-pressure readings will indicate this danger.

**Adjuvant Treatment.**—Protection against injury. Since the convulsions sometimes show frightful vehemence, the patient must be quickly undressed and put to bed surrounded with pillows, and watched by a trained attendant, preferably a physician. False teeth should be removed. To prevent the biting of the tongue the device illustrated in Fig. 343 may be used. A large wooden clothespin, wrapped in a thin handkerchief and hung near the head of the bed. As the patient sees the attack approach it is placed between the teeth, so that the rigidity of the prongs takes up the champing of the jaws. If the tongue is swollen and injury, it may be necessary, to prevent asphyxiation, to intubate, using soft-rubber tubing, or to do tracheotomy. Restraint of the movements should not be attempted—all that may be done is to keep the woman from injuring herself. Heart failure may be induced by forcibly holding the patient still. For extreme and exhausting jactitation morphine may be given, or, but rarely, an anesthetic may be used.

Mucus in the throat and mouth is to be removed frequently, but with gentleness, and it is best for the patient to lie on the side, to allow the oral secretions free exit—an especially important injunction during vomiting; these precautions are taken to prevent aspiration pneumonia. In the side position, too, the swollen tongue falls forward and frees the respiration.

All irritants should be withheld, which means that examinations are to be deferred, if possible, and the patient not disturbed only for absolutely necessary treatment. Visitors should be excluded from the room, which should be darkened, and the attendants should move about quietly, permit no loud talking, or stirring the bed, etc. As in all cases, these external irritants may excite a convulsion.

**Narcotics.**—Formerly chloroform was used for each convulsion, and even continued. G. Veit introduced the hypodermic treatment, and von Siedow gave chloral in large doses per rectum. Experience has not sustained these methods, and, indeed, they are symptomatic, since the attack is but a symptom of the cerebral intoxication. While the



FIG. 343.—USE OF LARGE CLOTHESPIN TO PREVENT INJURY TO TONGUE IN ECLAMPSIA.

Case of eclampsia at Mercy Hospital. Stage of stertorous respiration. Note swollen tongue.

repeated convulsions are a severe strain on the heart and the cyanosis involves both heart and general system, still it is the intoxication which is to be treated, and one should hesitate before adding other poisons to an already overloaded system. Without doubt chloroform causes many deaths, by degenerating the blood, and the heart muscle (secondary chloroform death), and morphine

increases the coma. The children often die from undoubted morphin poisoning. Lumbar anesthesia has been tried, but failed. The author uses narcotics and anesthetics as sparingly as possible.

*Elimination.*—On the theory that eclampsia is a toxemia, one would try to get rid of the poisons through the emunctories. Experience has been disappointing, as one would expect, since the toxin is probably colloidal, and closely bound to the nerve-cells. Cathartics should be withheld until the uterus is empty, because of the danger of infecting the operating field with liquid feces. After delivery a full dose of salts, jalap, or castor oil is given, but the patient is not to be strongly purged. Diaphoretics, especially pilocarpin, are to be condemned. Hot baths involve too much manipulation, but hot wet packs and alcohol sweats are recommended by many authors. They should not be used during labor, but afterward one or two may be given, though they are depressing and have caused death. In view of this fact, and because they have not proved of any real value, the author has dispensed with them. Another objection raised against the packs and sweats is that they concentrate the poison in the blood and thus the nerve-centers get a double dose, while the amount of poison thus eliminated through the skin is minimal.

Medicinal diuretics are too slow in action, if they are not objectionable, because irritating to the kidneys.

Diaphoresis and diuresis are best obtained by the free exhibition of liquids. Water and lemonade by mouth and salt solution hypodermically do more to favor the action of the skin and of the kidneys than any other means, but one must observe care not to overload either the stomach or the heart, accidents which the author has seen as the result of overzealousness. Liquids are administered to unconscious patients by stomach-tube, having due regard to the amount given and the possibility of some of the fluid penetrating the bronchial tubes. Salt solution is best administered hypodermically, a quart morning and evening. If the patient is very edematous, one should use less water. The use of salt does not harmonize with some theories regarding edema, but practical experience shows its value. Puncture or incision of the swollen limbs or swollen vulva may be indicated, under strict antiseptic precautions, of course. Advantageously combined with hypodermoclysis is the withdrawal of blood.

*Venesection* is one of the oldest remedies for eclampsia, but with the advent of chloroform it lost its prestige. Now it is coming into favor again as an adjuvant, and bids fair to hold a permanent, but secondary, place in treatment. In cases in which the convulsions recur frequently in spite of treatment, in which the pulse is full and strong, the face flushed or cyanotic—in short, when the picture might be called sthenic or apoplectic, bleeding will do good. In cases of the opposite type, bleeding is a procedure of doubtful utility. Stimulation is here more desirable. When the evidences of cardiac engorgement are present and pulmonary edema threatens, even if the pulse is weak, bleeding with stimulation may tide the patient over. By withdrawing a pint of blood one removes considerable poison, but bleeding also favors diuresis and diaphoresis. Venesection should be reserved until after delivery, since a hemorrhage at birth may make further bleeding unwise. It may be impossible to get enough blood from the vein, because it clots so rapidly and early in the incision. Letting the arm depend will aid here.

Oxygen is another adjuvant. It should always be used in the form of pure oxygen, and a great deal of it—a point frequently neglected while the oxygen tank is in the stuffy room. Oxygen is given during the convulsion and right after it, as quickly as possible, the cyanosis, and it is valuable also as a heart stimulant. Artificial respiration may be necessary to tide the patient over a syncope attack, or to improve the oxygenation of the blood between attacks. Veratrum viride, first

ed by Dr. Baker, of Eufala, Alabama, in 1859, has attained considerable repute in America and Italy as a specific, but large experience does not sustain it.

Other remedies, mentioned for the sake of completion, are thyroid extract (Lang and Nicholson); parathyroid extract (Vassale); alkalis (Zweifel), on the theory of acidosis; amyl nitrite (Jenks); trephining the skull and spinal puncture, on the theory that increased intracranial pressure is causative. The latter has produced a few remarkable results and deserves trial in desperate cases (Slemons); decapsulation of the mammæ (Sellheim); injection of air and oxygen into the mammæ, as is done for a similar disease in cattle (Healy and Castle); and renal decapsulation (Edebohls). Both theory and practice speak against the last operation. Chiriac collected 30 cases with a mortality of 46 per cent., and the clinical histories do not show that the decapsulation improved the conditions present with any regularity. Littauer reports 62 cases with 20 deaths, which is better, especially since only the serious ones were operated. The question of permanent damage to the kidney from the shrinking of the new connective-tissue capsule requires sober consideration. Dienst recommends hirudin, an extract of leeches, given intravenously to reduce the fibrin content of the blood.

*Stroganoff's treatment* is expectancy with narcotics. The patient is placed in a quiet room, disturbed as little as possible, and given morphin,  $\frac{1}{4}$  grain hypodermically, and chloral, 30 grains, per rectum about every three hours, according to the indication, which is convulsions. For each internal examination and catheterization, etc., chloroform or ether is given, also when a convulsion threatens. Sometimes this treatment is supplemented by venesection. Hot packs, fomentations, saline solutions, hot-water bags over the kidneys are adjuvants, and operative delivery is performed only if it promises to be easy or the patient evidently grows worse. McPherson uses very large doses of morphin, gastric lavage, colonic flushing with gallons of 5 per cent. glucose solution, and expectancy.

This method is only a revival of the practice of twenty years ago, and since it gives fairly good results, may be employed when the eclamptic cannot be given the services of an expert operator, or when the environment of the patient forbids the performance of a major operation.

The *after-treatment* is on the general lines just laid down. Water is given for twenty-eight hours, then milk and water, or rice-water with strained gruels, meat and other foods being withheld. Since the kidneys now begin to act freely, often 140 to 200 ounces of urine a day being passed, it is well to watch the bladder for overfilling. Involuntary bowel movements are the rule, and, therefore, the lochia should be arranged so that the feces do not dam up into the vulva. Warm-water bags are to be closely watched, because eclamptics are especially liable to burns and necroses. Sometimes spontaneous necroses resemble burns.

Since the convulsions may recur, even after a week, the puerpera requires constant supervision, and especially if she shows any signs of puerperal insanity, such as not seldom making attempts at suicide or infanticide.

The temperature of the eclamptic quickly subsides, a rise after such a fall indicating sepsis, pneumonia, etc. Nursing should not be allowed until the puerpera has been fully conscious for several days and the urine has become nearly normal, and when her strength permits. In a few reported cases and one of my own it has seemed that the milk of the mother caused convulsions in the child. (See also Woodall.) Pregnancy may not be allowed for two years, in order to give the kidneys and liver ample time to recuperate, and then only if the urine, blood-pressure, etc., show the perfect recovery.

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## CHAPTER XXVIII

### THE KIDNEY OF PREGNANCY

BARNES said that pregnancy is the test of bodily soundness, and it is generally admitted that the kidneys are the point of weakest resistance during this period. Leyden described certain changes in the kidney to which he gave the above name, believing that they occurred in a large percentage of kidneys in normal pregnancy. This condition is supposed to exist when the gravida shows edema and albuminuria in the latter half of pregnancy. The kidney is large, pale, soft, cloudy, with markings obliterated, anemic or grayish-yellow in color, and microscopically shows fatty changes in the glomeruli and tubules, but no infiltration of leukocytes or vascular changes.

Slight albuminuria, a moderate number of hyaline and granular casts, with white blood-corpuscles and renal epithelium, occur, according to Fischer, in 50 per cent. of the pregnancies, but in the author's experience such findings are always indicative of some compromise of the function of the kidneys.

In the author's cases albuminuria is always regarded with great suspicion, and if casts, especially granular or cellular, appear, the woman is considered ill and placed under treatment. As a rule, in these cases edema, lassitude, headache, high blood-pressure, and neuralgia accompany the urinary findings. The author considers the "kidney of pregnancy" the first evidence of a mild toxemia. Often the symptoms become aggravated—the albuminuria increases, casts, blood, and epithelium appear, the urine diminishes in amount, and the case develops the characteristic aspect of preëclamptic toxemia. Some writers call these aggravated findings the "nephritis of pregnancy," claiming that this leads to eclampsia or to coma. Clinically, it is impossible to differentiate these cases of nephritic toxemia from real eclampsia, though occasionally one may, from the predominance of renal symptoms, suspect that most of the trouble lies with the kidneys.

With our present views the "kidney of pregnancy" is the result of the intoxication of pregnancy, and the causation of eclampsia would be its causation. The kidneys suffer in their effort to eliminate toxins or undermetabolized products or insufficiently oxidized proteins from the liver, or the accumulated excreta of the fetus.

Some of the theories of the cause of renal disturbances are: Compression of the kidneys or the renal vessels by the gravid uterus (impossible); increased arterial tension (does not always exist, and may be the result or concomitant); spasm of the renal arteries, causing anemia and degeneration (merely hypothetical); the hydremia of pregnancy (not constant and usually absent in later months); compression of the ureters (occurs in only one-fifth of the cases, and is then usually unilateral, while the changes are bilateral); increased intra-abdominal pressure (this is not proved to exist in pregnancy, though it is generally believed that the blood from the extremities has greater difficulty in reaching the heart—large abdominal tumors seldom cause albuminuria); overwork of the kidneys (plausible); bacteriuria (very probably the cause of some cases, the author having proved that the urine of even apparently healthy pregnant women contains streptococci—see Pyelitis).

For the **symptoms**, see Eclampsia. The differential diagnosis is to be made from chronic nephritis with acute exacerbation, but it is seldom possible. A previous history of renal disease, the vascular manifestations of the latter, and the course of the present illness may show differences from the simple kidney of pregnancy.

Nephritis begins earlier in pregnancy. Retinitis albuminurica is more common in nephritis. In toxemia the retina, although the patient has eye symptoms, may show normal conditions or only edema. It is seldom possible to read the diag-

nosis from the urinary findings. In nephritis the amount of albumin may be less, with lower specific gravity and less coloring-matter. Zweifel's sarcolactic acid test has not been proved clinically useful, and the nitrogen partition gives equivocal results. Since the condition under consideration is the result of a toxemia, it is not surprising that pregnancy is frequently interrupted from the same cause (13 per cent., Fellner). The kidney of pregnancy may recur.

The treatment is the same as for threatened eclampsia (page 379).

### ACUTE YELLOW ATROPHY OF THE LIVER

Closely allied to hyperemesis and to eclampsia is acute yellow atrophy of the liver—the *icterus gravis* of older writers. Pregnancy seems to predispose to this disease, since over half the cases reported occur in pregnant women. It appears at any period of gestation, during labor, or in the puerperium. Without doubt several diseases may terminate under the clinical picture of acute yellow atrophy, and the author has seen hyperemesis gravidarum, eclampsia, sepsis acuta, and chloroform poisoning do so, also one case of secondary syphilis in a prostitute. Other authors report typhoid, osteomyelitis, diphtheria, erysipelas, anaphylaxis, phosphorus, alcohol, and ptomain-poisoning as precedent illnesses. It is sometimes epidemic. The causation is unknown, and whether the degeneration of the liver is due to infection or to a toxicosis is still *sub judice*. Bacteria (among others the streptococcus, Prochaska) and *Bacterium coli* (the author) have been cultivated from the liver, but since degeneration and not inflammatory changes are predominant, the theory of an intoxication is more plausible.

**Pathology.**—At autopsy the liver is found wasted, perhaps to one-half its volume, soft, friable, sometimes almost diffuent, yellowish streaked, and mottled with red. Rarely one finds an acute diffuse hepatitis or the evidences of other hepatic disease, in which case the liver may even be enlarged. The liver-cells have undergone albuminoid degeneration, the nuclei are indistinct or absent, and in the red portions the cells have disappeared entirely, or are found only at the periphery of the lobules. Tiny hemorrhages are sometimes found, especially under the capsule. The interlobular connective tissue appears increased because the liver-cells have dropped away from it and there is a slight wandering in of leukocytes. These probably have to do with the conversion and the carrying away of the fatty degenerated parenchyma, though it is probable that a proteolytic enzyme is also active. The heart, the muscles, and the glands of the bronchi and of the digestive tract are fatty degenerated, and all the tissues are bile stained. The kidneys are intensely involved, in one of the author's cases the convoluted tubules being completely degenerated, but the tubuli recti and the glomeruli being unaffected. This case showed no inflammatory changes, but such are reported by some authors. The spleen is large and soft, similar to that seen in the acute infectious diseases.

**Symptoms.**—Much variation exists in the descriptions given of this affection. If the hepatic atrophy is a termination of hyperemesis or of eclampsia, the symptoms of these disorders precede. If it follows the use of chloroform, the symptoms are very acute—may be fatal in from six hours to as many days. In the "idiopathic" cases a prodromal stage with anorexia, vomiting, constipation, headache, perhaps slight mental disturbances, extreme weakness, a tinge of icterus, and pain in the epigastrium exists, but its significance is not recognized. After a few days to a few weeks symptoms of serious illness appear, rarely with a chill and high fever (Vinay), but usually suddenly. Frequent vomiting, first glairy, then bilious and bloody, anorexia, thirst, pain in the epigastrium, acholic stools, with occasional hemorrhage, intense headache, restlessness, later extreme and incessant jactitation, with rolling the head to and fro on the pillow, insomnia, delirium, sometimes convulsions, and coma before death. In secondary chloroform poisoning I have seen the disease end fatally in six hours with all the characteristic symptoms appearing

rapid succession. Abortion usually takes place just before death, but may not occur. Otherwise uterine hemorrhage is infrequent.

Examination of the patient shows extreme exaggeration of reflexes, general icterus, sometimes of a lemon, sometimes of an orange-yellow, tint; minute petechiae on the trunk and extremities, or an erythematous eruption; a slight cyanosis of the face, with puffiness of the features; a dry brown tongue, with sordes; a characteristic but indescribable fœtor ex ore—it resembles the fruity odor of sepsis, but has a slight pungency; the pulse is fast, weak, and numbers 120 to 140 beats; the respirations are dyspneic, stertorous, and later weak and superficial; the temperature is almost always elevated,—102° to 104° F.,—but is rarely subnormal; at first contracted, later dilated, pupils are seen, together with slight exophthalmos; toward the end, however, the eyes are sunken; there is extreme tenderness over the liver and diminution of liver dulness, which is determinable by daily measurement; enlargement of the spleen occurs (66 per cent.); the urine is diminished, containing bile, albumin, casts of all kinds, fatty renal epithelium, blood, methemoglobin (Stumpf), often leucin balls and tyrosin crystals, very little urea (which, divided, shows a large percentage of ammonia nitrogen, indicating that the liver function is in abeyance), acetone, diacetic acid, indican, albumose, and peptone, but sugar rarely.

One or more of these symptoms or findings may be absent, but always, after the prodromal stage, there are enough present to make a positive diagnosis. The disease lasts a few hours or days after the real symptoms appear, the most rapidly fatal cases being those in which the cerebral symptoms, delirium, and agitation are worst. Death is due to exhaustion and intoxication, the heart giving out first, and it occurs in deep coma.

**Diagnosis.**—If a pregnant woman, after a week or two of lassitude, headache, and symptoms of gastric catarrh, suddenly develops delirium, jactitation, jaundice, with epigastric tenderness and diminution of liver dulness, the diagnosis of acute yellow atrophy is almost certain. If such symptoms appear after hyperemesis, eclampsia, and sepsis, the diagnosis may still be asserted, and differentiation is not necessary, since both may be due to the same cause, which may be unknown, or at least its action not understood. The administration of chloroform should be considered in the history taking. In those cases which begin with a chill and high fever the disease may be an acute septicemia with this unusual clinical picture. Confusion will arise only with "bilious" typhoid, yellow fever, and phosphorus poisoning, but a careful medical examination will usually procure clearness.

The **prognosis** is bad. Recoveries are reported, and while most authors claim these are mistaken diagnoses, the writer believes that he has had a case which survived the disease. The fetus is practically always lost, through either prematurity or toxemia. It is usually icteric, but in cases of simple maternal icterus the child is not jaundiced.

The **treatment** is symptomatic. In hyperemesis one should terminate pregnancy as soon as suspicions are aroused that the liver is beginning to suffer. Indeed, in all cases the pregnancy should be interrupted as soon as the diagnosis is made, unless the patient is so sick that the interference itself would precipitate the end. A vaginal cesarean section would be the best method under novocain.

### CHOREA GRAVIDARUM

Another disease which in all probability is toxemic or infectious in origin is chorea gravidarum. The causal connection between pregnancy and chorea is very uncertain, but predisposition is provided by heredity (neurasthenia, insanity, alcoholism, hysteria), previous chorea in infancy, nervous shock, as fear, anger, anemia, chlorosis, acute polyarticular rheumatism, endocarditis, infections of various kinds. In three cases observed by the author the picture was one of toxemia, and in two of them treatment on this hypothesis resulted happily. In



milder cases a hysteric element may be discerned; indeed, some authors distinguish a hysteric and an idiopathic form. Sometimes the movements are unilateral.

Chorea during pregnancy often becomes threatening, the movements at first localized, rapidly becoming general, incessant, violent, and preventing sleep. One observes anemia, exhaustion, delirium, perhaps maniacal, and later torpor, then fever, coma, and death. Emaciation, bed-sores, furunculosis, erythematous or morbilliform eruptions, cardiac murmurs, and albuminuria are sometimes found on examination. All degrees of severity are noted. Incontinence of urine and feces is of bad omen, and jaundice may also occur in such cases. The disease usually appears before the middle of pregnancy, rarely in labor, and still more seldom after; it lasts from eight days to months, disappearing, as a rule, with the expulsion of the ovum, whether spontaneous or induced. Recovery often occurs before term, delivery then being natural. The child may be choreic. The toxemic forms are acuter and seldom go to full term, abortion being common. Primiparae are most affected, especially if younger than twenty-five years, but when chorea appears in a multipara or recurs in a subsequent pregnancy, it is usually more serious.

The prognosis is grave, 20 to 30 per cent. of the women and over half of the children dying, the latter from prematurity. Permanent mental disturbances may follow, as after eclampsia. Death occurs from exhaustion, inanition, injury, decubitus, sepsis, endocarditis, and toxemia, shown by delirium and coma. At autopsy cerebral anemia, edema of the dura, thromboses of the sinuses, and emboli and softening of the cord may be found, but, again, there may be negative findings.

**Treatment.**—The general rules for medical cases apply here, but in view of the danger of the disease and its probable cause (toxemia), one should not temporize too long, but as soon as the movements become marked the patient is to be put in bed and placed on a milk-and-water diet. Sodium bromid in 60-grain doses, q. i. d., chloral, even morphin, may be administered, but the author was able only with hyoscin to calm the movements, and even this failed after a few days. By skilful nursing the nutrition is maintained and exhaustion prevented. Normal pregnancy serum should be tried.

Pregnancy must be terminated when it is seen that the general health has begun to suffer, certainly before incontinence, jaundice, fever, or delirium begins. Curiously, Wade saw recovery after dilatation of the cervix without abortion, as Copeman did in hyperemesis. If the uterus is emptied early enough, recovery is the rule.

### PRESUMABLE TOXEMIAS

Every physician meets conditions in pregnancy which are best explained by calling them toxicoses. Truly the expression means nothing definite, but the affections present the picture of intoxications and respond to appropriate treatment. Asthma in a woman who never had the disease before may have such a basis. Fainting spells, acute collapse, or even sudden death may have no other apparent cause. Such accidents strongly resemble anaphylactic phenomena. Peripheral neuritis may be of septic origin, but well-authenticated cases have been found as a complication of an almost certain toxemia,—hyperemesis gravidarum,—as in the case of Soloviev, quoted by Vinay, and one of my own. The tingling of the hands and legs, with numbness, even anesthesia and paresis, of which many pregnant women complain, are probably due to affection of the nerves by some circulating toxin. The nerve-trunks are tender and sometimes determinably enlarged, especially the ulnar. Since the symptoms disappear quickly after delivery, the injury to the nerves is slight, but grave forms of neuritis and polyneuritis do occur, either on a toxemic or an infectious basis.

Psychoses during pregnancy are usually toxemic. A bad heredity is found in nearly half of the cases, but this does not preclude the idea of a toxicosis, because we have seen that such taint predisposes to other toxemias, as eclampsia and

peremesis. It seems that disturbed metabolism is more common in women whose nervous systems are not equal to the strain of pregnancy. The author, in two instances of insanity in pregnancy, produced striking results with eliminative treatment, though in one mental disease developed after an afebrile puerperium of eight weeks. Korsakoff's psychosis has been observed in pregnancy. While usually alcoholic in origin, the syndrome, polyneuritis and delusions, may appear during the early months of gestation, and a toxemia may be involved. Williams and others believe that most cases of puerperal insanity are infectious in origin. The frequency of insanity after puerperal fevers is strongly suggestive, but very often the psychosis follows an eclampsia, a chorea, hyperemesis, or a normal puerperium, and their theories must be invoked. One might divide the cases into infectious, toxic, and idiopathic (heredity, inanition, exhaustion, anemic) psychoses. It is more than possible that some of the diseases we call toxemias are in reality infections, the causal bacterium still eluding our crude methods of investigation.

Most authors do not favor the induction of abortion or premature labor in the insanity of pregnancy, but the writer believes that the cases should be treated just as any other toxemia, unless the accoucheur, after consultation with an alienist, is convinced that the mental disease is simply contemporaneous with gestation, without direct causal relation. So far as the child is concerned, no indication for abortion will lie, because if the psychosis is toxemic, the condition is not necessarily transmitted to the offspring, and, further, we have no right to sacrifice the child on the assumption of the possibility of its being mentally unfit.

In some neurotic women I have seen the occurrence of pregnancy produce a degree of terror that certainly was close to mania. During labor acute insanity is sometimes observed in women of poor nervous balance, neuropaths, hysterics, when the pain is very severe. Without doubt the strain of labor is too much for many nervous systems, and the author believes that prolonged painful labor, without infection, will explain many cases of puerperal insanity. Transitory mental aberration during the agony of the second stage is not seldom observed, and it may be infanticidal or homicidal, a point of importance in medicolegal cases. It is an indication for immediate delivery.

During the puerperium and lactation insanity is a not infrequent disease, statistics of the asylums showing from 10 to 18 per cent. of female inmates affected at this time. Puerperal infection, mastitis, eclampsia and allied toxemias, postpartum and other hemorrhages, especially if grafted on a bad heredity, exhausting labor, the drain of lactation, are the most common causes. The attack may be developed by a violent psychic shock, such as death of husband or child.

Melancholia with suicidal intent was the most common form in the author's cases, but mania with infanticidal tendencies was also observed. Vinays says that the maniacal forms are most frequent. The prognosis is fair, the majority of the cases recovering in from six weeks to six months. The treatment is along general lines.

**Neuritis.**—Pain in the nerves, especially the trigeminal, the ulnar, and the sciatic, is frequently noted in pregnancy, and is generally treated as a neuralgia, but often prickling sensations, numbness, and slight paralysis of the member or members show that the nerve is more deeply involved—that a neuritis exists. Polyneuritis with marked paralyses, even atrophy, has been observed, and has been ascribed to toxemia. The degeneration of special nerves in hyperemesis gravidarum has been mentioned. Not rarely pregnant women complain of numbness and prickling of the fingers, with lack of power in the hands, and examination shows the members to be puffy, slightly cyanosed, with diminished tactile sensibility, and occasionally tenderness of the ulnar nerve is discovered. The nerves of the special senses may be involved—neuritis optica, auditoria, etc. (*q. v.*), and the pregnancy may have to be terminated to prevent permanent blindness or deafness. After delivery the symptoms rapidly subside, having been probably toxemic. Treatment is along these lines.

Puerperal neuritis is of the same nature, though Bar calls it septic. Monoplegias after delivery are probably septic. They are usually radial or cubital, Möbius believing that these nerves are points of predilection in puerperal infections. Sciatic neuritis is particularly intense when a puerpera is affected. Occasionally paralysis and atrophy result. While some of the cases are acute and heal rapidly, many pursue a course of months, and recovery may be incomplete. When the connective tissue of the pelvis is inflamed, the nerves of the sacral plexus not seldom are also involved, with peripheral muscular and sensory disturbances. Recovery occurs after the inflammatory process has subsided, but scar formation may render it incomplete.

Injury to the nerves in the pelvis by the forceps may result in peripheral neuritis or paralysis, but the prognosis is good. The differential diagnosis is on general lines—here need only be mentioned the rupture of the symphysis pubis, where the pseudoparaplegia, with abduction of the thighs, at first glance, might cause confusion. The findings over the pubis and the results of the neurologic examination will always clear the diagnosis. Treatment of neuritis is given in text-books on internal medicine. For toxemic polyneuritis it may be necessary to induce labor, especially if vital nerves—phrenic, pneumogastric, or the nerves of the special senses—begin to show the least involvement.

**Tetany.**—A disease, discovered by Steinheim in 1830 and studied by Trousseau, characterized by tonic spasms of the muscles of the arms and legs—occasionally general and very painful, without loss of consciousness. Minor symptoms are formication, paresthesia, muscular weakness or stiffness, and pains in the fingers during writing or sewing. Trophic disturbances may be noted, falling out of the hair and finger-nails, cataract, anomalies of the teeth. Examination shows excessive motor excitability, Trousseau's sign—contracture of the hand when the brachial plexus is compressed; Chvostek's sign—facial spasm when the facialis is percussed, etc. The disease in milder forms is not very rare, indeed, tetanoid symptoms are quite common in pregnancy, but the severe cases are rare and they may be fatal. The second half of pregnancy is the usual time, but it may appear during lactation. Recurrence is frequent. Labor is not affected, but the fetus may be macerated or die of convulsions. One of the causes of convulsions and death of the newborn is tetany, and this may be due to hemorrhages in the parathyroids the result of labor.

Parathyroid insufficiency is the cause of tetany, and pregnancy develops it. The lack of calcium due to the large amount consumed by the fetus may be contributory.

The treatment consists in the administration of large doses of calcium—30 to 60 grains of the chlorid daily, also hypodermically, parathyroid feeding or implantation, and the interruption of pregnancy if the state of the patient alarms. Ergot and chloroform are contra-indicated. (See Voegtlin.)

### BLOOD DISEASES

Older writers spoke of the condition of the blood during pregnancy as being one of chlor-anemia. Later studies show that in healthy women, rather, there is an increase of the reds, of the hemoglobin, of the fibrin, and of the white blood-corpuscles. Anemia in the early months, however, is not uncommon, especially if the woman was chlorotic as a girl. It is probable that the fetus obtains its iron from the maternal red blood-corpuscles, and this may explain the anemia of the early months, the blood-forming organs not being equal to their added tasks. The author frequently gives iron, arsenic, and mercury in combination during pregnancy, with success in anemic states. Chlorosis is a not infrequent cause of abortion which tonic treatment may prevent. Chlorotic women stand hemorrhage very poorly, a loss which may be insignificant for another being fatal to them, and, besides, they show a tendency to bleed—a point of great importance in the treatment of the third stage. Chlorosis, which is often a sign of general infantilism, may cause atonia uteri during the second and third stages of labor, and one may find a generally contracted pelvis too.

**Pernicious anemia** seems to be favored by frequent child-bearing, especially if the woman is otherwise weak or anemic. Hemorrhage favors the disease, and it may follow an infection; indeed, a careful diagnosis is necessary to shut out tuberculosis, syphilis, cancer, helminthiasis, chronic gastritis, intestinal infections, and other conditions which cause secondary anemia. A toxemia could cause the disease, but, although this theory has been advanced, no proof is shown. The same causes are said to excite leukemia which may occur during pregnancy, but it is doubtful if there is any special relation between the two. If there were, one should meet the disease oftener. Esch reports six cases where the clinical picture resembled pernicious anemia, but the hemolysis, etc., were probably due to a toxemia. The same causes are said to excite leukemia which may occur during pregnancy, but it is doubtful if there is any special relation between the two. If there were, one should meet the disease oftener. The prognosis is bad in both these affections, and the pregnancy should be terminated as soon as the diagnosis is made, though often neither child nor mother is much benefited by the interference.

Labor may occur naturally in these conditions without any particular tendency to hemorrhage, but sudden exhaustion, with coma and œdema pulmonum, has been frequently noted to follow a few hours after delivery. Leukemia does not pass over to the fetus.

**Hemophilia** is rare during the reproductive period. Contrary to most writers, the author believes that fatal cases of hemophilia can occur during delivery. Hemophiliacs may have profuse menses, and may bleed to death from defloration; they abort frequently, and may have post-partum hemorrhage or late bleedings in the puerperium. Hemophilia, or at least a hemorrhagic diathesis, can occur in a woman who has no family history of it, and in whom the bleeding tendency has not been in evidence in previous deliveries, abortions, or menstruations. The author is convinced that a temporary hemorrhagic diathesis can occur during pregnancy, its basis being a latent hemophilia, syphilis, malaria, intoxication by chemical or hemolytic poisons, a toxemia, or a sepsis. It is a generally admitted fact that toxemia disposes to hemorrhage. The hemorrhagic types of eclampsia, hyperemesis, etc., are particularly fatal. The blood in the cases observed by the writer was lake-colored, like port wine, the clots small, soft, and black. Suggillations, petechiae, and bloody infiltration around the vulva, vagina, and cervix and the hypodermic punctures betrayed the fact of a dissolution of the blood.

In one case of hæmatoma vulvæ (p. 761) the woman had a gingivitis with hemorrhages and other toxic symptoms which gave almost the clinical picture of scurvy. It is more than possible that a toxemia or infection lies at the bottom of these diseases. This subject is an inviting field for investigation.

So far as treatment is concerned, if the condition is recognized during pregnancy, the attempt should be made, by general tonic remedies, to upbuild the patient's strength. Iron, mercury, and arsenic have given the author good results. Calcium chlorid and gelatin are supposed to increase the clotting power of the blood, and may be administered for a few days before, during, and after labor. The author could not convince himself that any effect was obtained, a view also held by Robertson. The use of a heterogeneous serum, as that of the horse, has been advocated in cases of obstinate hemorrhage, as also has been human serum, and the results with the latter certainly encourage trial. The object is to supply the missing thrombin, thrombogen, and thrombokinase. In bad cases human transfusion is indicated.

The author has had two cases of polyglobulism, a syndrome with enlarged spleen, intense cyanosis, hypererythrocytosis. The spleens in both patients reached the brim of the pelvis; one woman had 8,000,000 reds and 60,000 whites, clubbed fingers, rheumatic pains, and general asthenia. One was sterile after having had two children before the disease appeared; one had two still-born macerated children, then, under iron, arsenic, and mercury treatment, a live child without trouble, followed by sterility. The pregnancy seemed to aggravate the general conditions very much.

## SKIN DISEASES IN PREGNANCY

A close relation exists between the skin and the changes in the general metabolism due to pregnancy. Virchow and Neusser believed that there is some relation between the ovaries and the skin. Of the milder manifestations of the disturbed nutrition of the integument may be mentioned the pigmentation, hyperidrosis, edema, falling of the hair, cracking of the nails, erythema, acne, etc. While most skin diseases are aggravated or even developed, some are cured by the advent of pregnancy. Pregnant women may have all the dermatoses that other women have, and, since the reaction is usually more severe, it is probable that many of the affections hitherto designated as gestational are really merely coincident. The latest and most complete exposition of the subject is given by Scheuer.

**Pruritus** is an affection, perhaps neurotic, perhaps toxemic, usually localized on the vulva, sometimes general, which begins in the middle or end of pregnancy, and may rarely reach such an intensity as to demand the emptying of the uterus. Diabetes should always be looked for. Neurasthenic and hysteric women more often have the itching. Genital pruritus is often a symptom of varicose veins, edema, vulvitis, vaginitis, cervicitis, with leukorrheal discharge, and in these cases the skin of the vulva is thickened, red, and shiny. Mycosis vulvæ is not infrequent in multiparæ. Lack of cleanliness is another cause of itching. Eczema and other dermatoses must, of course, be sought. The pruritus is usually worse at night and in summer because of the warmth, and the patients lose sleep. After delivery recovery promptly ensues. Subsequent pregnancy usually shows recurrence. In several cases the author found evidences of renal inefficiency, and one woman had a uriginoid eruption on the arms, legs, back, shoulders, and chest. Besnier called his form of pruritus "prurigo gestationis." He describes an itchy eruption of tiny papules closely grouped, especially on the backs of hands and feet, appearing usually after the third month, recurring in successive pregnancies, and disappearing after delivery. Usually the skin is normal in appearance except for scratch-marks. The treatment is general and local. If diabetic, the usual treatment; if toxemic or neurotic, appropriate remedies will be employed. Sodium bromid in 20-grain doses

often produces sleep. A bland diet, without condiments, spices, and alcoholics, and one with little protein, is prescribed—in short, general hygienic conduct. Baths may be tried, but the author has had little success with them. Very light clothing, with linen next to the skin, is good. For local use on the skin the author has had success with this lotion:

R. Carbolic acid .....	0.5 per cent.
Zinc oxid,	
Finely levigated calamin, of each .....	15.0   “
Lime-water .....	to make 100.0   “

For pruritus vulvæ the author has used with varying success the following applications: Chloral hydrate, 5 to 20 gm. per liter; bichlorid of mercury, 1 : 1000; carbolic acid, 2 per cent. solution; essence of peppermint, 4 c.c. per liter; an ointment consisting of ichthyol, 2 per cent., menthol, 0.5 per cent., ointment of rose-water, a sufficient quantity; or, carbolic acid, 0.5 per cent., menthol, 1 per cent., zinc-oxid ointment and ointment of rose-water, of each, a sufficient quantity.

The washes and ointments are to be applied cold, after cleansing the parts thoroughly with tar-soap and water, using much soap. In cases of mycosis vulvæ the white patches are to be painted with 10 per cent. silver nitrate, and the patient given a dusting-powder of boric acid. This smarts a good deal, but is helpful. For irritating discharges the best results have been obtained with daily potassium permanganate douches, 1 : 3000, followed by one of essence of peppermint, a teaspoonful to a quart of cool water. In cases that are obstinate one should try calcium in the form of Locke's solution, a pint daily hypodermically, failing which, the serum of a healthy pregnant woman should be given, 30 c.c. every day for three days. Pituitary extract is also recommended, but not the x-ray.

*Locke's solution:*

Sodium chlorid .....	9.00
Potassium chlorid .....	0.15
Calcium chlorid .....	0.25
Aquæ dest. ....	1000.00

Excessive pigmentation cannot be combated during gestation. It may be associated with the adrenals. If the mask of pregnancy does not disappear within six months after delivery, the parts may be rubbed with pure lemon-juice morning and evening, which, failing to remove the stains, a treatment with bichlorid of mercury may be recommended, under the care of a good dermatologist.

Excessive hirsuties, very rare in pregnancy, usually disappears of itself.

Brickner describes a disease which he calls fibroma molluscum gravidarum. The forehead, chest, shoulders, arms, and hands, in the order named, present pedunculate, pinkish, warty excrescences, in size from a pin-head to a bean, which drop off before or surely after labor. A tendency to warts is known to exist in pregnancy, but no one had described this disease. The writer has seen ten cases of it, but in none was the eruption so generalized as in Brickner's. Treatment is symptomatic.

**Edema.**—More than half of all pregnant women show some edema of the feet, the hands, or the face. Often this is an elastic puffiness which does not pit. The cause of this is not known. A real anasarca, with exudation of serum in the tissues, is usually due to toxemia, renal or hepatic, and is produced by the alteration of the constitution of the blood or capillaries or both. It is present in the morning in the feet, hands, and eyelids, sometimes disappearing by night.

Edema which grows worse during the day is usually due to mechanical causes—varicose veins, tight garters, cardiac disease, and obstruction to the abdominal circulation (twin pregnancy, pendulous belly, abdominal constriction). The accoucheur is warned not to conclude lightly that an edema is mechanical or of no significance because the urinary findings are negative. A nephritis may exist without albuminuria, and eclampsia may occur with no other warning than the anasarca. Edema with high blood-pressure is ominous.

The treatment is plain when the cause is discovered. General obstetric hygiene usually suffices. (See p. 230, *The Conduct of Pregnancy*.) It has been suggested that the amount of salt in the food be curtailed, but the author has not seen constant improvement under this regimen. Rest in bed with milk-and-water diet is one of the best means we have. Excessive edema is always pathologic, and usually preëclamptic, and, therefore, treatment directed against the toxemia is indicated. Puncture of the swollen tissues should not be done unless the patient is in labor and soon to be delivered, because of the danger of infection from the prolonged drainage and, of course, extreme antisepsis will be observed.

**Special skin diseases**, described by writers as due to pregnancy, are very rare. *Herpes gestationis* is a form of herpes which appears during pregnancy, especially on the arms, legs, face, and chest, in the order named, passes through the usual states of grouped vesicles, small bullæ, pustules, and crusts—is of chronic nature, and liable to recurrence in subsequent pregnancies. Very probably other affections, for example, erythema multiforme and dermatitis herpetiformis, have been called herpes gestationis.

*Impetigo herpetiformis* (Hebra), on the other hand, is a serious disease (mortality, 80 per cent.), sufficiently characteristic to be called a gestational affection, though it is rare in America. The following is a description of the author's typical case treated in conjunction with Dr. Josef Zeisler:

A quintipara, aged thirty-seven, had the disease in her third pregnancy and miscarried, but not in the fourth, a normal pregnancy. Since four weeks she has been bedridden because of general weakness, vomiting, diarrhea, insomnia, pain in the legs, and an eruption which began on the inside of the thighs and has slowly spread all over the legs, trunk, and arms. Groups of pustules, pin-head to lentil in size, appear, coalesce, form crusts which fall off and litter the bed, leaving reddened skin. The lesion extends progressively in all directions. The center of the large areas is healed, but large patches of epidermis are elevated in places, resembling pemphigus. In the genital region the crusts and excoriated skin produced a red, fetid, oozing, bleeding surface. The mouth was early affected, showing gray plaques.

The general condition of the woman is poor, but she has no fever,—contrary to Kaposi,—a pulse of about 100, and there is slight icterus. At eight months the woman aborted, whereupon the eruption rapidly disappeared and the woman quickly recovered. The child showed no eruption. Bacteriologic examination of the pustules and of the blood was negative. Polyuria was present, with a trace of albumin, diminished urea, no sugar, no peptones or indican, and no casts.

The cause of impetigo herpetiformis is unknown—an infection or a toxemia appears probable. Wolff-Eisner believe it is of an anaphylactic nature, the foreign protein coming from the uterus. Mayer believes it is a toxemia, and that the system does not react with sufficient antitoxin. He therefore injected 20 c.c. of the blood-serum of a healthy gravida to supply the antitoxin. Result, cure in three cases. Treatment is palliative, but the author, having observed the rapid subsidence of the disease following the expulsion of the fetus, if rapid amelioration did not allow Mayer's treatment, would induce labor.

During the puerperium the author has observed the following skin diseases: urticaria; acne; furunculosis; erythema multiforme; pityriasis versicolor; drug eruptions, *e. g.*, quinin; urticaria from too free use of cresylic acid preparations; eczema from bichlorid, which in one case became a generalized eruption with high fever, and was erroneously called by the attending physician an erysipelas. Septic eruptions will be discussed under Puerperal Infections.

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## CHAPTER XXIX

### LOCAL DISEASES INCIDENT TO PREGNANCY

**Varicosities.**—Varices of the legs or of the vulva or hemorrhoids are found in a majority of pregnant women. While marked varicosities are present in only one per cent. of gravidæ, a few dilated veins are an almost constant accompaniment of pregnancy. The veins of the ankles, legs, thighs, vulva, vagina, rectum, and ligaments are affected, in frequency and degree, according to the order given. One or the other form may be alone present or predominant. Fine venous networks or large packets of tortuous veins, resembling bunches of angle-worms, are observed. The vulvar lips may be enlarged and spongy (Fig. 132). They resemble varicose veins and cause much the same distress. Edema often attends varicosities. The patient complains of pain, fatigue, burning, itching, and a feeling of tension in the affected parts. In some cases the veins are so dilated and the legs so edematous and painful that the patient can hardly walk. After the delivery of the child the varicosities collapse, and they almost always disappear in three weeks. The causes of varicosities are not known, but pregnancy surely has much to do with developing them. Women who are much on their feet and have to work hard, multiparæ with a large and heavy belly, women with heart disease, are most afflicted, and a special disposition can also be observed. This may be congenital. Frequent pregnancies and abdominal bands and garters also favor them. Varicosities are not due to pressure of the gravid uterus on the veins of the pelvis, because this is impossible, and to increased intra-abdominal tension, because this seldom exists to such a degree. That there is some obstruction to the return circulation from the legs is highly probable, but there must be some change in the vessel-wall or of the blood which predisposes to venectasis during pregnancy. Toxemia again has been suggested as also a vasodilating ferment from the corpus luteum. It may be the same condition which causes the pelvic vessels to enlarge and dilate with the progress of pregnancy. That some such relation exists is proved by the fact that in some women the varicosities enlarge as soon as conception occurs, and that they collapse if the fetus dies in utero. With other abdominal tumors varicose veins of the legs are rarely observed. At this point may be used in the differential diagnosis. A woman was sent to the author from a neighboring city for her accouchement. She was suffering from carcinoma of the ovaries with immense abdominal distention. There were no varicosities, but the patient said she had had such in all her six pregnancies.

Varicosities, beyond the pain they produce, are dangerous because they may ulcerate, become infected (phlebitis and periphlebitis), may thrombose, sometimes give rise to emboli, and may burst, allowing fatal hemorrhage. Vaginal, vulvar, and broad-ligament varices may rupture also into the connective tissue, causing hematomata, which may be fatal from internal hemorrhage, or, becoming infected, from sepsis. During labor vaginal and vulvar varicosities not seldom are tortuous, requiring quick diagnosis and immediate suture or firm tamponade, because the bleeding is profuse. Differential diagnosis from placenta prævia, abruptio placentæ, and atony of the uterus must be made, which is done by inspection and feeling for the bleeding vessel. A hematoma occurring during labor may obstruct the delivery of the fetus. Treatment consists in opening and packing the cavity of the cervix, the cervix is dilated, then removal of the packing, delivery, followed by repair of the cavity of the hematoma and the uterovaginal tract. Occasionally a va-

bad ligament will burst into the peritoneal cavity, producing the symptoms of gestation, and one may thus rupture during labor, the patient dying of intra-uterine hemorrhage without a drop showing externally to apprise the accoucheur of the cause of the fatal anemia.

Swelling, occurring in broad-ligament varices, may lead to emboli, which may break off during labor, and this warns of gentleness in handling the uterus during the third stage or during the puerperium.

**Treatment.**—A hemorrhage from a varicosity is easily controlled by pressure alone. The patient must be instructed to avoid injuring and infecting the superficial veins by scratching them or knocking against things; to avoid coitus if the varices are vulvar or vaginal, and she should be taught how to stop hemorrhage by waiting for help if one of them should bleed. Phlebitis and periphlebitis are treated by rest in bed, moderate elevation of the leg, and wet boric-acid dressings. Rest must be enjoined for three weeks, or until it is judged that the thrombosis is complete and the thrombus firmly organized—this to avoid the danger of embolism. Suppurating thrombi of the legs are to be drained. Little can be done in the bad cases of varicosities during pregnancy, but I have helped several by the administration of calcium. A rubber stocking or flannel bandage may be worn, and the feet held elevated whenever possible. More comfort is gotten by the application of adhesive strips placed spirally around the limbs while the patient is recumbent. They divide and support the column of blood.

**Hemorrhoids** occasionally are very obstinate and annoying to the pregnant woman, who perhaps is not affected with them under other conditions. Hemorrhoidal fissures, with exuberant granulations, or extrusion and gangrene, may occur. Amputation is not to be made during gestation, but the usual treatment may be pursued. During labor the hemorrhoids come out, swell up, and may bleed. They may give rise to lacerations of the perineum. An attempt should be made to replace them with a pad. Some accoucheurs use this opportunity to remove them, but probably it is best to wait until the puerperium is over. Postpartum, hemorrhoids often cause a great deal of distress. If the piles are internal, they may be reduced, under ether if necessary; if external, no such attempt may be made, but the hips should be elevated and cold applied to the parts. If there is a hemorrhage into one or the other pile, it may be incised under local anesthesia and the blood drained out, but the author prefers medical treatment where possible. The author uses these prescriptions, in order:

- |        |                           |                |
|--------|---------------------------|----------------|
| (1) R. | Acidi tannici.....        | 2.0            |
|        | Ext. hamamelis.....       | 12.0           |
|        | Menthol.....              | 0.5            |
|        | Ext. opii aq.....         | 0.5            |
|        | Ung. aquæ rosæ.....       | q. s. ad 100.0 |
|        | Fiat unguent.             |                |
| (2) R. | Ichthyol. ammoniat.....   | 25.0           |
|        | Glycerini.....            | 75.0           |
| (3) R. | Bismuthi subgallatis..... | 3.0            |
|        | Ext. hamamelis.....       | 8.0            |
|        | Acidi carbolic.....       | 0.3            |
|        | Ichthyol. ammoniat.....   | 5.0            |
|        | Ung. aquæ rosæ, }         |                |
|        | Lanolini..... }           | ad 100.0       |

**Relaxation of the Pelvic Joints.**—The ancients believed that the pelvic bones separated during delivery and labor thus was rendered possible. Later this view was dropped, and cases where such separation occurred were called abnormal. In the guinea-pigs all the joints, especially the sacro-iliac joints soften, and in guinea-pigs all the joints, especially the sacro-iliac joints soften and enlarge, allowing wide latitude of motion. In the human there is no doubt but that the joints soften, thicken, and thus enlarge the cavity of the



## CHAPTER XXX

### EXTRA-UTERINE PREGNANCY

A **BETTER** term is ectopic pregnancy, or *eccyesis*, which means a gestation which occurs outside of the cavity of the uterus. Extra-uterine gestation is the term more commonly used, but this would exclude from the study those cases where pregnancy develops in the interstitial portion of the tube.

An ovum may be fertilized and remain at any point of its passage from the ovary to the uterus (Fig. 344). The most common sites of its nesting are the tube, median or isthmal, its ampullary, its uterine or interstitial, portions, in the order named, and, lastly, the ovary. Primary abdominal pregnancy has been reported in the posterior fold of the broad ligament and on the omentum (Hirst and Knipe, Ryzewicz, Graefe, Hammacher, and Galabin), but it is of such exceeding rarity that need only be mentioned. Hecker considered it very common, but these were secondary abdominal pregnancies. Pregnancy has developed in a sinus, possibly within a piece of Fallopian tube, following vaginal hysterectomy, and also in the stump of

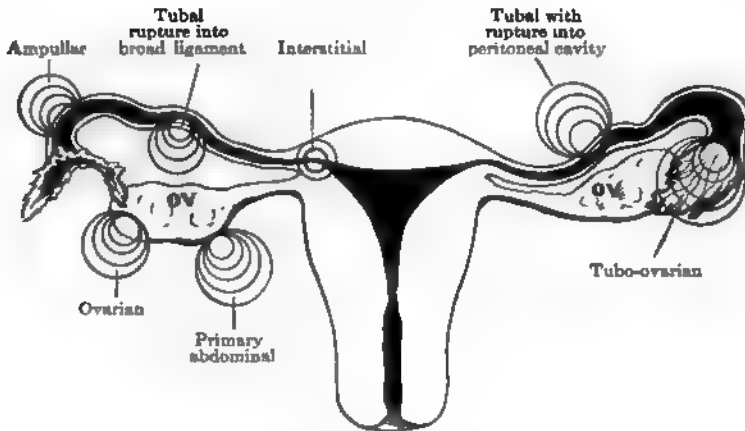


FIG. 344.—DIAGRAM OF LOCATIONS OF ECTOPIC OVA.

tube after partial salpingectomy. Pregnancy may occur in a closed accessory horn of the uterus and on the fimbria ovarica of the Fallopian tube. In the latter instance we speak of a tubo-ovarian form. As the ovum distends its container other structures are encroached upon, adhesions form between them, and the primary topography of the gestation is modified. When the tubal wall bursts, the fetus escaping into the free abdominal cavity or into a mass of preformed adhesions, we speak of tubo-abdominal pregnancy; if the rupture occurs in the lower portion of the tube, between the folds of the broad ligament, an intraligamentous sac is formed; the sac which is formed in an interstitial pregnancy bursts into the uterus (rare), we speak of tubo-uterine; if the ovarian pregnancy goes toward term, it almost always becomes ovario-abdominal—these are all secondary forms, and clinically, as well as anatomically, hard to distinguish from each other.

**Causation.**—The first mention of extra-uterine pregnancy is by Abulcasis in the tenth century, and Riolan, in 1626, refers to several cases. Since then the sub-

ject was frequently noted, and recently, since operative interference has become common, an enormous literature has accumulated (Werth).

Extra-uterine pregnancy is quite frequent, and occurs also in the lower animals—the ape, cow, sheep, bitch, and hare. Many cases of rupture of the sac, or tubal abortion, and spontaneous recovery undoubtedly occur, and pass under the diagnosis of appendicitis or abdominal colic. “Prostitutes’ colic” is surely often of this nature. It is more frequent in city than in country practice; oftener after the thirtieth year—frequently after a long period of relative sterility; and in women who have had an antecedent pelvic disease. Repetitions of the accident in the same tube and in the other tube have been reported, and intra-uterine and extra-uterine gestation may coexist. Bilateral ecyosis was first noted by Noier. 1595.

The actual causes are unknown, but the following have been advanced, with more or less plausibility, in the order named: (1) Salpingitis; (2) pelvic adhesions; (3) infantile tubes with lack of cilia; (4) external wandering of the ovum; (5) diverticula and accessory tubes; (6) decidual reaction of the tubes; (7) disease of the corpus luteum (Fränkel, Schill, and Opitz).

Salpingitis may act either by the loss of the cilia, which should favor the motion of the ovum to the uterus, or by gluing the folds of the mucosa tubæ together and forming blind pouches in which the ovum is caught, or by occluding the tube through the kinks or swelling. Gonorrhea is a frequent antecedent, but puerperal infections and other inflammations like appendicitis are also found. Pelvic adhesions may bind the tubes and ovaries down and compress the lumen of the tube, or prevent the escape of the ovum from the neighborhood of the ovary. Infantile tubes are much convoluted (Freund), and perhaps have little propelling power. In cases of external wandering of the ovum it may have grown so large that it is unable to pass the lumen of the tube, and during the long journey the trophoblast has had time to develop, so that it can attach itself anywhere, or perhaps the slow motion imparted to the ovum by the weakened or undeveloped or adherent tube gives it time to become fixed. Much of the above is purely theoretic.

## PATHOLOGY

**Tubal Pregnancy.**—This is by far the most common form. Whether the ovum rests in the ampulla, the median, isthmic, or the interstitial portion of the tube, the course is the same, the trophoblast producing cytotoxicity of the cells of the tubal mucosa, and the ovum then burrowing into the wall of the tube, in a way distinctly analogous to that of pregnancy in the normal uterus. A decidua may or may not be formed, but usually one finds islands of decidual reaction in and near the implantation of the ovum, and even in the other tube. As the ovum grows it bulges the wall of the tube inward, occluding its lumen, the cells of the opposing surfaces necrose, and the capsularis, if there is one, fuses with the opposite side of the tube. The villi erode their way into the blood-vessels and between the muscular fibers. Conditions in the wall of the tube are so different from those in the thick decidua of the uterus that the dangers of tubal pregnancy are easily grasped. In the uterus the ovum develops in the thick decidua and in a mucous membrane capable of strong decidual reaction, which membrane might really be considered a protective wall against the advancing army of villi. The blood-vessels are small, and the muscle of the uterus is physically adapted to stretching and hypertrophy. On the other hand, in the tube there is little or no decidua, and the advancing villi rapidly eat their way into the muscle-fibers and into the blood-vessels. These latter are large, and the muscle of the tube is not so capable of hypertrophy and stretching. Indeed, in the tube the ovum acts like a rapidly growing destructive neoplasm.

The ovum may be arrested between two folds of the redundant tubal mucous membrane, or it may attach itself to the top of a fold (Werth). Minute differences

the early development of the ovum result here, but they are of no clinical importance. In either case the growing ovum distends the tube to the point of rupture. Some hypertrophy of the tube occurs in all cases, and in rare ones the tube grows until term without rupture, these being the instances where it has been supposed that muscle-fibers could develop in an adventitious sac.

Usually the hypertrophy of the muscle of the tube is insufficient to accommodate the egg, and the fibers at the placental site being separated and destroyed by the erosive action of the villi, a weak spot here results. Any traumatism, as straining at stool, a jar, coitus, a bimanual examination, causes a slight hemorrhage at this site, with a rupture, or the tube bursts from overdistention of the thinned walled wall, and the villi lie free in the peritoneum. This is called extracapsular rupture. Bleeding naturally results from each of these occurrences. If the site of the rupture was on the free portion of the tube, the hemorrhage takes place into the peritoneal cavity, a hematocele forming in the pelvis. When the tube bursts into the broad ligament, a hematoma develops there. Rupture of the tube is the usual termination of isthmic and of interstitial pregnancy, and it almost always occurs in the second and third months.

When the ovum is in the ampulla, the gestation sac, in developing, may point in the direction of the fimbriated end of the tube, and a process known as *tubal abortion* is the usual termination.

The course of tubal abortion resembles that of uterine abortion very closely—a hemorrhage occurs in the decidua serotina, loosening the ovum from its bed. The



FIG. 345.—TUBAL ABORTION IN PROGRESS, WHEN A RUPTURE OF THE TUBE FROM NECROSIS CAUSED SUCH A HEMORRHAGE THAT OPERATION BECAME IMPERATIVE. COMBINED INTRA- AND EXTRACAPSULAR RUPTURE.



FIG. 346.—TUBAL HEMATOMA FROM TUBAL GESTATION. INTRACAPSULAR RUPTURE.

blood and the ovum now fill the overdistended tube. The bag of waters may rupture and the fetus escape among the clots in the lumen of the tube. This is called intracapsular rupture. Blood oozes through the fimbriated end of the tube and clots around it, slowly forming a hematocele in the lower pelvis. The ovum and clots are gradually extruded through the open end of the tube into the peritoneal cavity, and they are all finally absorbed, unless the hemorrhage has been so great as to demand surgical interference (Fig. 345). If the extrusion does not take place or is not awaited, the hemorrhages into the tube destroy the ovum and it becomes converted into a mola carnea, very like those often found in the uterus (Figs. 346 and 347). In these early moles it is rare to find the little fetus—it has been destroyed or even absorbed. Unless one finds the fetus or demonstrates villi, the diagnosis of ectopic gestation may not be made. In molar formation also a slight amount of blood may ooze into the pelvis and bind the tube to neighboring structures.

**Hematocele.**—Very soon after the blood touches the peritoneal surface it clots, and the peritoneal surface also throws out a layer of fibrin. Adhesions are thus quickly formed between the tube and the neighboring organs, and the blood is encapsulated. This is a hematocele, and the sac is composed of the fibrin mentioned, the neighboring organs, mainly intestines, bound together by adhesions. When a new bleeding occurs from the end of the tube, the newly formed sac is overdistended

and may rupture, the process of adhesive reaction being continued a shorter longer distance, in the direction of least resistance. Another hemorrhage can



FIG. 347.—CROSS-SECTION OF EARLY MOLE, ENLARGED.

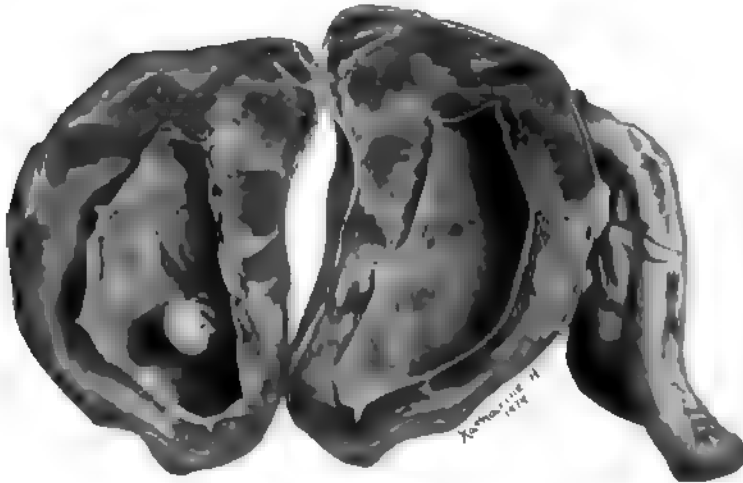


FIG. 347a.—CROSS-SECTION OF EARLY MOLE. NATURAL SIZE.  
To the right is the appendix adherent to the tube.

repetition of the process, and the woman may die from the repeated losses of blood. This slow hematocele formation is the rule in tubal abortion and tubal mole, but may occur with a slow rupture of the tube as well.

When the tube bursts, it usually does so suddenly, and a profuse intraperitoneal hemorrhage results. If the woman does not die from shock and the anemia, this blood, too, is walled off and a large hematocoele forms. This condition is common in isthmic and in interstitial pregnancies. Rupture of the tube may occur at any part of its periphery. Sometimes the perforation is minute, the villi seem to have actually eaten a hole through the wall.

**matoma.**—When the rupture of the tube takes place into the broad ligament, the two folds are torn asunder by the blood, and one finds a mass lateral to

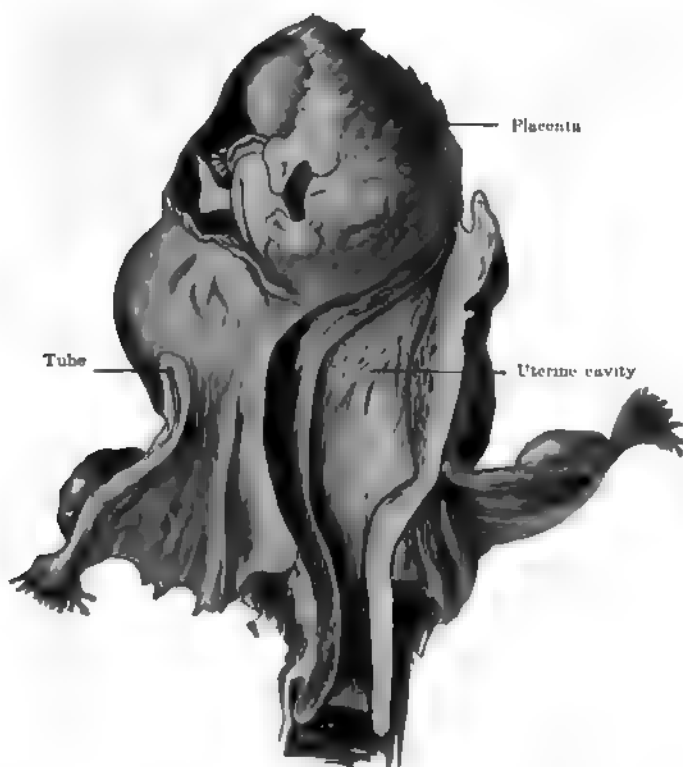


FIG. 348.—INTERSTITIAL PREGNANCY (Simon, Berlin, 1885).

the ovary, extending variably to the wall of the pelvis, under the round ligament, and into the iliac fossa.

The fetus does not always die. Sometimes the rupture occurs at a point in the body of the ovum which does not affect the placental site, and then the embryo escapes into the peritoneal cavity or between the folds of the broad ligament and continues its development. These are secondary abdominal pregnancies. Secondary abdominal pregnancy may also result when the tube, not rupturing, but immensely thinned, forms one layer of a sac, which in the main is composed of lamellated and adherent intestines and omentum. Such sacs may be readily pedunculated at operation. If the fibers of the tube grow and are very slowly distracted, an interstitial pregnancy may also develop into, and between the folds of, the broad ligament, without the violent symptoms of rupture. Still, in all forms there may be late rupture of the sac.

Interstitial pregnancy (Fig. 348) has the same terminations as tubal, that is, miscarriage, mole, and abortion, the latter occurring into the uterus (rare). The corner of the uterus is developed, distorting the rest of the organ. Rupture is of late occurrence, because the uterine wall is capable of more hypertrophy than the tubal,

and the ovum may die, or it may develop to maturity in the broad ligament. The gestation sac may grow into the uterus and then continue as a normal pregnancy. (See Angular Pregnancy.) Such a diagnosis is exposed to much question, but cases not infrequently occur where this explanation of the phenomenon seems very probable.

Ampullary gestation pursues the same course as the others, but abortion is the usual termination, because the open end of the tube is near by. The ovum may be inserted on the fimbria ovarica, and in such an event the pregnancy is almost entirely abdominal, and the sac is made up of lamellated fibrin and adherent intestines, uterus, ovary, and omentum. The placenta spreads out over the tube, ovary, pelvic wall, and back of the uterus. It may be attached to the omentum.

**Ovarian Pregnancy.**—This is one of the rarest forms, but its occurrence is proved, there being over 72 cases on record. Norris, Penkert, Young, Lockyer, 1917, and Shea give a résumé of authentic cases, with the literature. It is not easy to decide that a given case is truly ovarian in origin, because the sac quickly makes adhesions to the tube or uterus, or a pregnancy on the fimbria ovarica may tear loose from its attachment or grow over onto the ovary, and one cannot decide if the location of placental tissue on the latter is primary or secondary. To establish the anatomic certainty of an ovarian pregnancy all that is necessary is to prove that "the tube, including the fimbria ovarica (excluding also gestation in an accessory tube), is absolutely free from any part in the formation of the fetal sac" (Werth). Werth evidently considers primary abdominal pregnancy so rare that it need not be considered.

Ovarian pregnancy pursues the same course as tubal. The impregnation of the ovum by the spermatozoid takes place before the former leaves the ovary, and if the ovum was deeply located in the ovary, the sac is evenly covered by ovarian stroma; if it was superficial, the fetal sac grows out into the peritoneal cavity. In both cases the pregnancy is pedunculated and easily removed, though it does contract adhesions with the surrounding structures. If the ovum was near the hilum, the gestation-sac may become intraligamentous, spreading the utero-ovarian ligament apart, and showing the tube stretched over its exterior, as occurs on a cystic tumor of the ovary in a similar location. Rupture of the sac, with hematocele, is the usual termination, with or without death of the fetus, but molar formation is also observed. One may not say a hematoma found in the ovary is always the result of a pregnancy, unless chorionic villi or parts of a fetus be demonstrated in it. Rupture of a Graafian follicle is sometimes attended by free, even threatening, hemorrhage, and hemorrhagic ovarian cysts or twisted ovarian tumors may cause pelvic hemorrhage. A differential diagnosis of such accidents from ectopic gestation cannot be positively made before operation.

**Later Course.**—If a tubal pregnancy terminates by abortion, the extruded mass of clots and the embryo are rapidly absorbed. Tubal moles also disappear in the same way, but more slowly, and subsequent permeability of the tube is established. If, in rupture, the placenta became detached, torn, or disorganized by blood-clots, the fetus dies, and, unless advanced beyond the eighth week, the little body is absorbed. The blood-masses slowly shrink, harden, and are dissolved by leukocytic and ferment action, disappearing in a longer or shorter time, depending on their size.

If the child escapes alive, it may continue its development among the intestines or in the broad ligament, *i. e.*, secondary abdominal pregnancy. In either case it may have escaped inside an intact amniotic sac or naked. A new sac now forms, made up of fibrin, adherent intestines, omentum, uterus, broad ligament, etc., depending on the location in which the fetus happens to be. In the structure of the no traces of the original container, tube or ovary, will be found, except at one point, the site of the rupture.

If rupture of the container does not take place, but the tube or the ovary distends, accommodating the growing ovum, a large pelveo-abdominal sac is formed

which becomes adherent to all the surfaces it touches—pelvic wall, uterus, bladder, rectum, intestine, omentum, liver, spleen, stomach. This sac in structure shows the site of the original site of implantation of the ovum, such as tube, ovary, together with lamellated fibrin, muscular fibers from neighboring organs, especially the broad ligament and the peritoneum, to which it at first adhered. The sac varies in thickness from 1 mm. to several centimeters, depending on the amount of fibrin.

The placenta is spread out over the tissues adjacent to its first point of development, is usually thin, but otherwise like a uterine placenta. The blood-vessels in the neighborhood of the placenta are enormously dilated, and many new ones are formed—this especially when the omentum is used to help nourish the placenta. In one of the writer's cases the newly formed blood-vessels in the omentum were as large as crows' quills, had very thin walls, tore easily, and were innumerable distributed over the sac.

In one or the other of these fashions the secondary abdominal pregnancy may go to term. Spurious labor now sets in, the child dies as the result of hemorrhage into, or dislocation of, the placenta, or may not die until later, and nature tries to get rid of the foreign body. The contractions of the uterus expel the decidua, and usually the attendant hemorrhage is slight. At any period of pregnancy the sac may rupture, or the child may die and the changes about to be described may be inaugurated. Spurious labor with expulsion of the uterine decidua may follow the death of the child at any time. There is always a degree of peritonitis in ectopic gestation with hemorrhage, and this, according to Dudgeon and Sargent, is due to the *Staphylococcus albus*, and is a conservative process. Jaundice is also frequent from absorption of more blood-pigment than the liver can take care of.

After the death of the fetus it first becomes macerated, as in intra-uterine pregnancy, then the liquor amnii is absorbed, the sac lays itself onto the body, a zone of granulations fills the interspaces, and the soft parts of the fetus are absorbed, *i. e.*, it is skeletonized. By way of the blood, or by passing through the intervening wall from contiguous structures, especially the bowel, infection may gain entry to the mass, and it suppurates, the pus finding its way out through the bladder, the rectum, or, least often, the vagina or abdominal wall. *Edema bullosum* can be seen in the bladder when the perforation into this organ begins. Through the fistula are passed, first, the broken-down fluid placenta, then the soft parts of the fetus, and finally the separate bones, by a process of suppuration which may last months or years, and which the patient may not survive. Sometimes, even after months, the woman dies from hemorrhage due to rupture of the sac, sometimes from peritonitis, but rarely, since firm adhesions have walled off the danger-zone.

Another termination after death of the fetus is mummification, the child drying up, and in this state it may be found years after. Absorption of the water of the fetus takes place, and it is surprising how well its tissues are preserved. Calcium salts are deposited in the sac around the fetus, and if these are abundant, the child is incased by a shell or even partly calcified itself—*lithokelyphos*, or *lithopedion* ('stone child'). Wagner had a case where a mummified fetus was carried for twenty-nine years, and Virchow one for twenty-eight years. Smith describes a calcified fetus which was removed from a woman ninety-four years old sixty years after conception. There are many cases on record. Suppuration may occur at any time even after calcification is marked.

**Changes in the Uterus.**—In response to the stimulus of pregnancy (what it is, we do not know), the uterus hypertrophies as if it were carrying the ovum itself. It enlarges to the size of a three months' pregnancy, its walls are thick, and it exhibits intermittent contractions. A decidua develops in it, and this may be as much as 1 cm. in thickness, presenting all the characters of an intra-uterine pregnancy decidua, *except that it contains no chorionic villi*. At the time of spurious labor or spurious abortion the decidua is cast off, either in one piece, as a cast of the uterine cavity, or in large shreds or plaques, sometimes accompanied by fetor.

Combined extra- and intra-uterine pregnancy is not very rare, Weibel, in 1995, having collected over 119 cases. Penkert found 17 cases in 1912 and 1913. Double tubal gestation has been observed, also two gestation-sacs in one tube. Twins, and even triplets (Baldwin), have been found in one sac. Fœtus papyraceus may also occur in combined gestations, as well as in twin ectopic gestation.

Extra- and intra-uterine pregnancy offers a very serious prognosis. Abortion of the uterine ovum precedes or follows the rupture of the ectopic sac, but death from internal hemorrhage may occur before abortion takes place. Rarely the woman goes to term, and then labor is usually spontaneous, but death frequently follows from internal hemorrhage or sepsis starting from the abdominal mass. The extra-uterine fetus rarely obstructs the passage of the intra-uterine. If the ectopic pregnancy is successfully removed, the patient may go to term with the other one normally.

Repeated extra-uterine pregnancies, after months or years, are not seldom observed, and the recurrence may be situated in the same tube originally affected or in the other.

### CLINICAL COURSE

Rarely do the first months of an ectopic gestation pass without symptoms which would direct attention to the pelvis as the seat of trouble. Once in a while a woman, previously perfectly well, has sudden symptoms of internal hemorrhage and may die from the same even before a diagnosis can be made. Medicolegally, the question of foul play may have to be settled in such instances.

Usually the patient misses a period and has the ordinary concomitant symptoms of early pregnancy, but soon complains of pains in the lower abdomen, especially on the affected side—cramp-like, due to uterine and tubal contractions. There may be mild pelveoperitonitic symptoms. After a few weeks irregular bloody vaginal discharges appear, which the attending physician believes indicate a threatening abortion. On the occasion of a jar, a strain, coitus, or an examination a sudden severe pain is felt on one side, *the patient feels faint or dizzy*, and may vomit or be nauseated. Symptoms of shock may appear, and the shock may be due to the sudden distention of the tube, to irritation of the peritoneum by blood, or to the great loss of blood. The pains continuing, a piece or all of the uterine decidua is discharged. A careless attendant will now conclude that the abortion has taken place. These symptoms may indicate that a hemorrhage has occurred in the tube, or through it into the belly, or that a rupture of the tube has taken place. Rarely is the first hemorrhage so severe that the patient dies—clotting occurs at the site of rupture and the blood is absorbed, the acute symptoms subsiding in two or three days, the whole process terminating in three to six weeks. Again, because the clot is disturbed or the blood-pressure raised, the hemorrhage recommences in a few hours or days,—almost never after weeks,—and the patient may die from a slower anemia or from a second or third severe hemorrhage. The gradual withdrawal of blood from the general circulation may be determined by the hemoglobin estimates taken daily. Tubal mole seems to cause repeated hemorrhages, the hematocele sac breaking at different points, fresh adhesions forming, and new additions to the sac being made. If the case is not treated, nature often works a cure, the sac being bound off by firm adhesions and the clots being slowly absorbed. Nowadays, however, most cases are operated on. In rare cases the pain may be referred to another part of the abdomen—the gall-bladder, for instance—and sometimes intestinal symptoms, like an enteritis, predominate. Jaundice is occasionally observed when the absorption of blood-pigment is active. Pyosalpinx may complicate ectopic gestation.

The symptoms of rupture of the sac are pain on the affected side, sometimes excruciating and sudden, soon spreading all over the lower abdomen; nausea, sometimes vomiting, sometimes diarrhea plus evidences of hemorrhage and shock.



That shock plays a real part in the symptoms is certain, because the author has found severe prostration without enough blood-loss to explain it. The striking pallor with slight cyanosis about the lips, pearly conjunctivæ, yawning and sighing, fast, small pulse, and extreme weakness reveal the fact of blood-loss. Rarely the pulse is slow—even 46—but feeble, the blood-pressure being very low.

Internal examination, if the blood is still fluid, will usually reveal only a large uterus; later, when the blood has clotted and the hematocoele is forming, one can outline the mass in the culdesac. Under particularly favorable circumstances the finger may feel a soft bulging downward of the culdesac earlier. When the rupture has taken place into the broad ligament, a hematoma forming here, the pain is most intense, and shock overbalances the anemia, because of the tearing asunder of the layers of the peritoneum. Internal examination will always disclose a firm mass on one side of the uterus.

If the rupture or the tubal abortion occurs more gradually, the symptoms are proportionately less stormy, and the true condition may not be discovered.

If, after the escape of the ovum into the peritoneal cavity or into the broad ligament, it continues to develop, symptoms of peritoneal irritation arise—pain, soreness, nausea, vomiting, diarrhea and constipation (sometimes hemorrhages from the bowel), bladder disturbance, loss of strength, and invalidism. The signs and symptoms of pregnancy continue, fetal movements are more pronounced, are painful, and may distress the patient, and the signs of tumor in the belly grow with the weeks. This tumor may be asymmetric or median. If the fetus dies, the symptoms of pregnancy disappear, while those usually made by a macerating neoplasm become noticeable, evidently due to a toxemia. Subfebrile temperatures, rapid pulse, anorexia, coated tongue, loss of weight, and invalidism are almost always in evidence. Subicterus, even marked jaundice, is often a striking symptom. Icterus with fever denotes beginning decomposition of the sac and contents. Now the patient gets really sick, since an abdominal abscess is forming, and she may die of sepsis, of peritonitis, or of exhaustion and hectic, from prolonged suppuration, the product of conception being gradually expelled through a fistula into the bladder, the rectum, vagina, or belly-wall.

If the sac goes on to lithopedion formation, involution of the uterus occurs, the irritation of the peritoneum subsides, and the patient may forget that she was pregnant, and may even have children normally. Cases are on record where an extra-uterine tumor, offering an obstacle to delivery, was found to be a calcified fetus.

Rupture of the sac and suppuration may occur at any time during pregnancy, a point of practical importance in treatment. The symptoms and anatomic course of a pregnancy in a rudimentary horn of the uterus are so similar to those of ectopic gestation that these subjects should be considered together.

## DIAGNOSIS

Before rupture of the tube or a hemorrhage into it the diagnosis of ectopic gestation has hardly ever been made, because the tube is as soft as an intestinal loop. Kanavel reports a case of a woman who had ectopic gestation once before, diagnosing a recurrence after going over her period one week, and operation proved she was right. Miller, of Pittsburgh, discovered a mass in a tube which he had palpated a few weeks previously, when it was empty, and proved the ectopic pregnancy by operation. Almost all the cases, however, where such a diagnosis has been reported were tubal abortions in progress or tubal moles. Tubal mole is often diagnosed. In the early part of pregnancy the diagnosis must decide if an extra-uterine tumor is an ovum or not, and during the latter half one must decide if the ovum is extra-uterine or intra-uterine. No pelvic condition gives rise to more diagnostic errors. The author has seen such mistakes made by every gynecologist and surgeon in the city, including himself. In the majority of cases the patient will give a history of

Perforation of the uterus and rupture of a pus-sac, or other abdominal hollow organ, give the same symptoms, and it may be necessary to open the belly to find out the true conditions.

If infection of a hemocele or of a hematoma sets in, the condition cannot be differentiated from a pyosalpinx, a pelvic cellulitis, or perimetritis, unless operation or puncture shows the hemorrhagic nature of the pelvic tumor. Jaundice is an important sign, since it usually accompanies a degenerating blood-clot. Treatment is on general principles of pelvic infections.

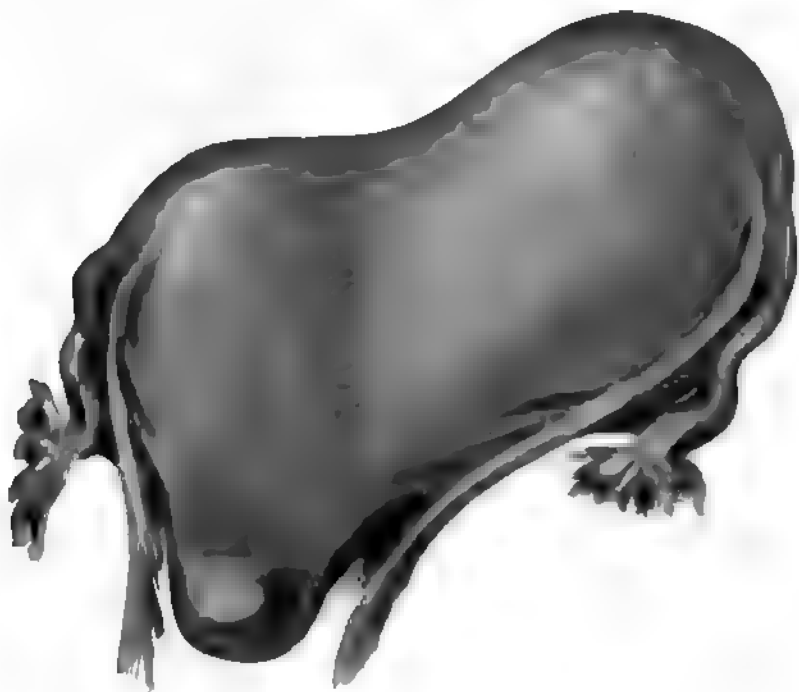


FIG. 349.—ANGULAR PREGNANCY AT FOUR MONTHS SIMULATING ECTOPIC GESTATION (Mrs. S., twins at term).

In the early months confusion is often caused by a long cervix softened at its upper part, which allows the fundus to bend backward or *to the side*. The cervix is hard, is held to be the uterus, and the fundus is thought to be the ectopic sac. By straightening out the uterus the diagnosis may be made certain, but before attempting to do so the presence of an eccyesis must be ruled out. Or the pregnancy is situated in one horn of the uterus and distends this side, the rest remaining hard. This is an "angular pregnancy," "*grossesse angulaire*," and is not seldom the cause of error (Fig. 349).

#### INTRA-UTERINE ANGULAR PREGNANCY

1. History is that of normal pregnancy, though, not seldom *grossesse angulaire* causes occasional slight hemorrhages and pains.
2. No expulsion of membrane, unless abortion.
3. No anemia.
4. Demonstration of tube and round ligament on outside of the tumor. (See Fig. 349.)
5. Can feel the wall of the uterus pass over onto tumor, especially during a contraction.
6. The tumor is soft, feels like a pregnancy, is high up in the side of the pelvis, and movable as a part of the uterus.
7. The angular portion of the uterus contracts.
8. Gradually the typical shape of the uterus returns.

#### EXTRA-UTERINE PREGNANCY

1. History of colicky pains and peritoneal irritation for several weeks; then a stormy event (rupture), with severe pain, shock, etc.
2. Expulsion of decidua.
3. More or less anemia.
4. Tube and round ligament not palpable, or medial to the tumor.
5. The mass is separated from the uterus by a groove. This is especially deep in pregnancy in an accessory horn.
6. The tumor is harder, lies at the side of the uterus or in the culdesac, and is not movable (careful!).
7. No contractions of the sac.
8. The tumor becomes more and more asymmetric at successive examinations.

Angular pregnancy cannot be differentiated from interstitial pregnancy except by the clinical course. It is well, therefore, to place the patient in a hospital for observation.

Pregnancy in a retroverted uterus has often been thought to exist when the real condition has been an ovisac or a hematocele in the Douglas culdesac, and attempts to replace the supposed uterus have resulted disastrously.

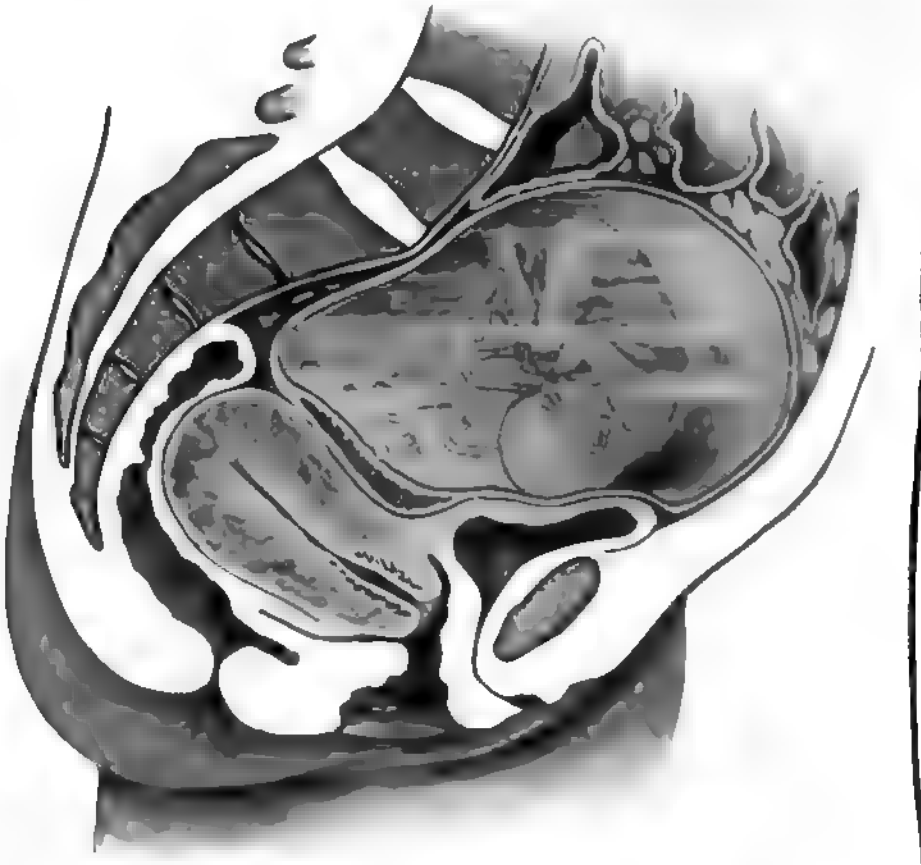


FIG. 350.—*Mrs. L., RETROVERSIO UTERI, WITH PREGNANCY ON TOP AND AT SIDE OF IT.*  
 Diagnosis at first, retroversio uteri gravidi, then, when abdominal tumor did not subside on catheterization and the fetus was felt above left Poupart's ligament, correct condition discovered. Laparotomy, recovery.

#### RETROFLEXIO UTERI GRAVIDI

- 1 History typical of pregnancy.
2. Urinary difficulties usual and marked after ten weeks.
3. Pain and hemorrhage rare and slight.
4. The finger feels the angle at the cervix, and nothing where the fundus should be (Fig. 357).
5. The retroflexed fundus is round, smooth, more or less movable (careful!), feels like a pregnancy, and sometimes contracts.
6. Late in pregnancy, condition is rare, and in cases of partial retroflexion cannot feel an adjacent, but empty, uterus.

#### ECTOPIC GESTATION

1. History strongly suggestive of abnormal gestation.
2. Seldom bladder symptoms until after fifth month.
3. The opposite is the rule.
4. The finger feels an angle, but the abdominal hand finds the fundus, and occasionally the Fallopian tubes, in front of the mass.
5. The mass in the culdesac is irregular, not movable, putty-like, does not feel like a pregnant uterus, and never contracts.
6. Late in pregnancy may find an adjacent mass which represents the enlarged empty uterus (Figs. 350 and 351).

Pregnancy in the uterus, complicated by ovarian or other cystic pelvic tumors, give rise to a diagnosis of ectopic gestation, especially since the accoucheur is in danger of overlooking the latter and wishes to operate on this account. This mistake is pardonable because usually, in either case, the abdomen would have been opened. Adnexa tumors, pyosalpinx, hydrosalpinx, and ovarian cyst may be mistaken for ectopic sacs. The main point in the diagnosis is the finding of the enlarged uterus alongside the tumor and the *absence of the symptoms and signs of pregnancy*. On the other hand, the *presence* of the early signs and symptoms of pregnancy does not speak against an extra-uterine tumor being a new-growth or inflammatory, because milk in the breasts, subjective symptoms, softening and coloration of the cervix and vagina occur in many of the latter pathologic conditions—indeed, even under normal circumstances. The author has seen colostrum in fine streams from the nipple of a nullipara thirty-eight years old, and has expressed milk from the breasts of a woman eight years after her last child.

Pyosalpinx cannot always be differentiated from tubal gestation, and they may co-exist. The presence of fever, leukocytosis (the polynuclear neutrophiles), excessive tenderness, evidences of acute or recent gonorrhea, and bilateral tumor usually settle the diagnosis, but they may *all* occur in extra-uterine pregnancy. If by

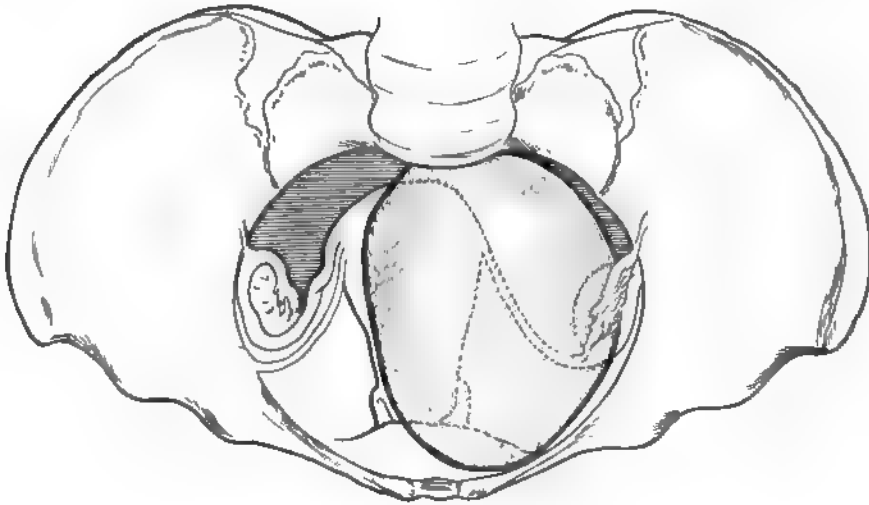


FIG. 351.—DIAGRAM ILLUSTRATING CONDITIONS FOUND IN FIG. 350.

the time the belly is opened and an acute pyosalpinx found, it is wiser not to attempt removal at this time, because such operations have a high primary mortality.

In rare instances the differential diagnosis of rupture of a gestation-sac with appendicitis must be made from rupture of a pus-tube, the twisting of an ovarian tumor, the bursting of an appendiceal abscess, of the gall-bladder, perforation of the stomach or duodenum, nephrolithiasis, ureteral stone, rupture of the splenic artery, but the scope of this work forbids going so far into the subject.

The serum diagnosis of pregnancy has not qualified as a trustworthy aid in difficult cases.

Acute appendicitis has not seldom been mistaken for extra-uterine pregnancy, when real pregnancy co-exists, the differential diagnosis cannot always be made.

#### APPENDICITIS

No signs or symptoms of pregnancy.  
Pain, nausea and vomiting, fever.  
Tenderness and rigidity high up.

#### ECTOPIC GESTATION

1. Present.
2. Pain worse, vomiting less; fever absent or less.
3. Tenderness and rigidity much less and low down.

## APPENDICITIS—(Continued.)

4. Leukocytosis usual.

5. Patient flushed and excited. At very beginning there may have been a little dizziness.

6. Uterus and adnexa normal.

7. Feel a tumor high up in pelvis.

8. No uterine symptoms.

## ECTOPIC GESTATION—(Continued.)

4. Leukocytosis equivocal. The blood-count shows increase of the polymorphs and mononuclears, the basophiles with the signs of secondary anemia. Low Hb.

5. Pale and faint or apathetic.

6. The characteristic findings.

7. Tumor low in pelvis.

8. Discharge of decidua.

In all cases where the diagnosis is uncertain the patient should be put in a well-equipped hospital, there to rest in bed until developments occur which shed enough light to allow a positive statement. Whenever an anesthetic is to be given for the examination the patient likewise must be in a hospital, to be ready for immediate laparotomy if the sac should be burst by the manipulations.

The author has never found it necessary to use a sound or to curet the uterus to make a diagnosis. In one instance the patulous cervix invited the finger, which entered the uterus and found it empty; nor has puncture of a mass with the exploring needle been often required. All these operations are dangerous, through possible rupture of the sac, decomposition of the sac, and injury to the viscera, and are to be employed when all other means fail and a diagnosis must be made. Further, the information obtained is not always unequivocal. If the curet brings decidua and no villi, the condition may be either intra-uterine or extra-uterine pregnancy, or both (v. Ott), or neither—only a dysmenorrheal membrane. A large, thick, rough decidual membrane expelled from the uterus, giving a more or less complete cast of the cavity, without chorionic villi, is almost pathognomonic of ectopic gestation. It may be expelled after the operation. Acetonuria is common in eccyesis, but not pathognomonic. Hemoglobinemia is present with rupture, and, with the spectroscope, hematin may be discovered, particularly in cases where jaundice is present.

Skiagraphy has been used to aid the diagnosis, but has not been very satisfactory as yet, for obvious reasons. In the late months the x-ray will be helpful. A lithopedion would show well, but it could not be differentiated from a calcareous fibroid unless the outline of the fetal bones were discernible.

In the later months the diagnosis is mainly concerned with differentiating whether a given fetus is intra- or extra-uterine. These points will aid the decision: History of unusual occurrences; of rupture in the early months; pelvic peritoneal symptoms; invalidism; painful fetal movements located in one place all the time; continual pain and abdominal distress; irregular hemorrhage and discharge of decidua; finding the empty uterus alongside the tumor; fetal movements active and very superficial, seeming to be almost beneath the skin; same of the fetal body, but it is not easy to make out the presentation, etc.; heart-tones exceptionally strongly audible, but sometimes not to be heard at all; sac exhibits no contractions; round ligaments are not palpable on the sac, as they are on the sides of the uterus; the tumor is not symmetric and easily definable, like a pregnant uterus; the examination is painful and unsatisfactory.

## PROGNOSIS

Naturally, it is impossible to give satisfactory figures in such a multicolored disease as this. Without doubt the outlook has been painted too dark, for very many ectopic ova die, are expelled from the tube as abortions or by rupture, and the patients recover without a diagnosis having been made. Many women recover under expectant treatment, but, of course, all the children die. In the cases which go to term the fetus is usually deformed or not viable. Sittner collected 179 cases and finds that, from the condition of the fetuses, one may allow the pregnancy to go on unless the symptoms of the mother are threatening. Most authorities find the opposite conditions. Fifty per cent. of the fetuses are deformed, according to

n Winkel—the head in 75 per cent.; the pelvic end in 50 per cent.; the arms in per cent. Pressure by neighboring organs causes compression, decubitus, imbrications, inflections, etc., of the body, and disease also, as hydrocephalus, meningocele, cranioschisis. These are due to amnionitis, insufficient liquor amnii, and kinking. Amniotic bands and velamentous insertion of the cord are common, and the placenta may be thick and hard, or infiltrated with hemorrhages.

It is interesting to note that polyhydramnion can occur in extra-uterine gestation, though oligohydramnion is the rule and accounts for the frequent fetal deformities. Hydatid mole and chorio-epithelioma have also been observed. Hydrops gravidarum and eclampsia may enter as complications (Pinard, Spiegelberg, Horwitz).

Schauta found 75 recoveries and 166 deaths in 241 cases treated expectantly, and quotes Veit as saying the mortality of ectopic gestation with hematocele is 10 to 28 per cent. Death results from hemorrhage, shock, or sepsis.

The prognosis as to health is also bad, because the condition leaves peritonitic lesions, which often result in sterility; if untreated, decomposition and abscess cause hectic fever, invalidism, etc.

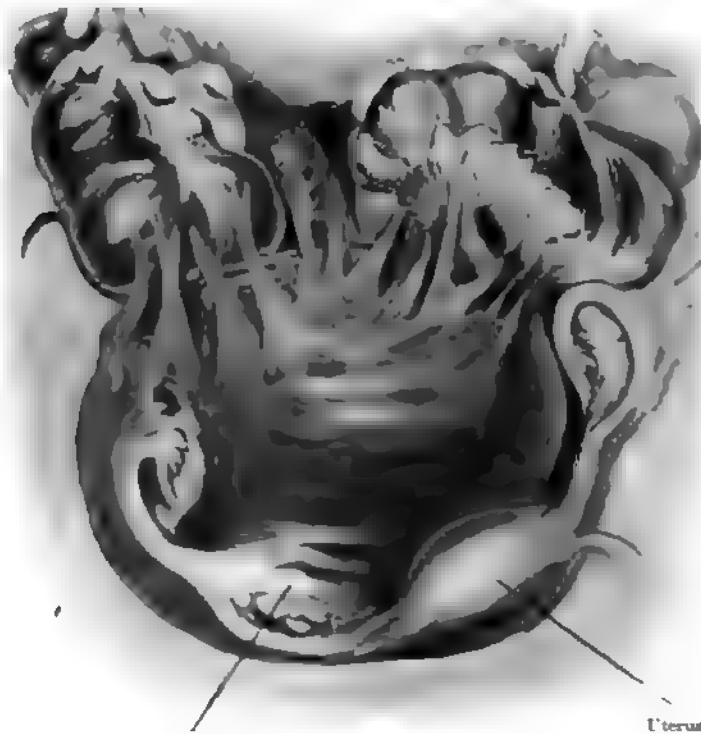
### TREATMENT

There is no expectant treatment for a growing ectopic gestation. The "extra-uterine body" (Werth) must be removed from the abdomen as soon as possible. If the diagnosis is made before rupture of the sac, or during a tubal abortion, the indication is to remove the ovum, preferably by laparotomy. Under such circumstances the operation is easy, resembling an ordinary salpingectomy.

If the pregnancy is advanced beyond the fourth month, the fetus having considerable size, the adhesions of the sac to neighboring organs being extensive and numerous, and, most important, the vascular connections of the sac, especially the placental region, being much greater, the operation becomes more and more formidable. In spite of Sittner's statistics, therefore, it is best to interfere as early as possible, and not to wait for the child to be viable. Exceptionally, or through religious scruples, the patient may demand delay to save the child, and in this event she must be put in a hospital to await the time of operation. At the end of pregnancy it is recommended to wait for the fetus to die and operate seven to twenty days thereafter, the object being to permit thrombosis of the placental vessels and the consequent diminution of the blood-supply to the parts (Litzman). This advice is seldom followed by experienced abdominal surgeons, and the results of immediate operation compare very favorably with those of the waiting policy.

The operation should be undertaken only by one skilled in abdominal surgery, because complications, hemorrhage, injury to intestine, ureters, etc., are very common. If the pregnancy is intraligamentous or tubal, without many adhesions, it is often possible to pedunculate the tumor and remove it as an ovarian cyst, after tying the ovarian vessels at the brim and clamping the broad ligament at the uterus. The placenta, together with the sac, may then, little by little, be dissected from the floor of the pelvis, clamping and tying the vessels. The bleeding areas are dried by suture, cautery, packing, or sewing the peritoneum over them. When the placenta is attached to the uterus, the sigmoid, the small intestine, or the omentum, one will come upon innumerable large and small blood-vessels running from these organs onto the sac. These blood-vessels are so thin that they seem to have only two layers of cells, for they break under the lightest touch, and the field is instantly flooded with blood. It may be necessary in such a case to open the sac, remove the child and as much of the sac and placenta as is safe, leaving the rest, but sewing the edges of the sac to the abdominal wall after firmly packing it. While it is most desirable to remove the whole ovum, this way may lead more surely to success. The remnants or the whole of the placenta separate and are discharged by suppuration in the course of four to sixteen weeks. When the placenta is on the anterior abdominal wall, the primary hemorrhage is great, but it may be checked by pressure or compression of the aorta high above the bifurcation, as has been done by the author at cesarean sections. In one of the author's cases the hemorrhage from vascular adhesion was absolutely frustrated all attempts at hemostasis by a skilful surgeon and himself. The placenta was adherent to the omentum and gut, the former being simply a mesh of brittle arteries and veins. In a similar case Momburg's belt might possibly be tried. Several cases have been treated by simply removing the fetus and cord, sewing up the sac, and leaving it for later absorption. The results do not recommend the procedure.

**Treatment of Rupture and Tubal Abortion.**—Since the differential diagnosis may not be possible, both conditions are treated alike. There seems no doubt but that the best treatment, as soon as the diagnosis of rupture of the sac with intra-peritoneal hemorrhage has been made, is to open the belly and remove the pregnant organ. Salt solution is given by hypodermoclysis, and the belly quickly opened. The author uses ether anesthesia. Blood may shoot up several inches from the incision. One grasp locates the uterus; it is pulled up into the wound, and a clamp put on the broad ligament of the affected side. Another grasp brings the sac into view, and a clamp is put on its pelvic side. Fresh bleeding is thus checked, and the removal of the sac is now undertaken deliberately. A search is made for the fetus, which is usually found very near to the site of rupture. The largest clots are scooped out, but no time is wasted in the peritoneal toilet, and the belly is rapidly closed. Salt solution is given continuously under the breasts throughout the opera-



Ruptured sac forming part of hematocoele

FIG. 352.—APPEARANCE ON OPENING BELLY AFTER RUPTURE OF PREGNANT TUBE. MRS. L.

tion and after it, not intravenously, except in very critical cases, and then, if possible, human blood should be transfused.

If one is called to a case when the primary hemorrhage has ceased, the patient recovering from the shock, one may wait a few days, but must be ready to operate on the first suspicion of renewed hemorrhage. Preparations must be made at home or the woman sent to a hospital. My own preference is for immediate operation.

If a hematocoele forms, which is easily determined by the hardening and forming of the pelvic blood-mass, one may remove same by laparotomy, by vaginal incision and drainage, or may allow it to become absorbed. Fehling thus treated 91 cases successfully. The patient must be kept under hospital observation until the mass is very hard and firm—that is, until it is certain that the fetus is dead and that

There is no danger of further hemorrhage. She should stay in bed until absorption is completed. Absorption takes four weeks to four months, depending on the size of the blood-tumor. While most small hematoceles become absorbed, the large ones are very slow, and if they do not rupture, allowing renewed bleeding which demands operation, they not seldom suppurate, in either case causing prolonged invalidism and leaving permanent damage in the pelvis and consequent sterility. This is especially true if the fetus had attained some size. Such patients do better with an abdominal operation, and the author prefers the abdominal to the vaginal method (Fig. 2), since it gives better control of all eventualities. It is now almost the general practice.

If a hematocele forms but the pains continue, and especially if the patient has alarming spells, one should decide that hemorrhage is recurring and operate at once. Should the temperature, chills, rapid pulse, pain, and peritonitic symptoms point to infection of the gestation-sac, it must be drained as soon as possible. Suppurating hematoceles are broadly opened through the posterior culdesac as one does a pelvic abscess, and a soft-rubber tube inserted, without any attempt to remove clots and without irrigation. If the pregnancy is further advanced, but accessible from below, the same method is employed. If it is already an abdominal pregnancy, the belly is to be opened, the sac sewed to the edges of the incision and opened the next day with the cautery, thus avoiding infecting the general peritoneum. Its ectopic contents are removed piecemeal and slowly, requiring days or weeks.

Veit, in 1884, operated first for unruptured tubal gestation. Veit also operated first, according to Werth, for intraperitoneal hemorrhage in 1878, then Tait in 1880 and 1883, though Jewish and Parry had suggested the idea. One of the obsolete methods of treatment of the ectopic pregnancy with living fetus was the attempt to kill the fetus by morphin injected into its body or into the liquor amnii, or by drawing off the liquor amnii, or by electricity.

Robb believes it is not advisable to operate if shock is too profound. The majority of couchers favor immediate rather than postponed operation, since it is impossible to make sure that bleeding is not going on, and, further, it is desired to give saline solution, which may not be given until the torn vessels have been closed. My own experience is in favor of immediate operation. It requires only two minutes to get clamps onto the broad ligament. In the presence of a profuse internal hemorrhage one need not remove the patient from her bed. The belly can be painted with iodine, opened rapidly, and the broad ligament clamped, the rest of the operation being completed as soon as practicable.

Watkins recommends uterine curetage to remove the decidua, which otherwise comes away piecemeal, attended by bloody flow or fetor. In several of my cases the decidua did not come away at all. Wallace transplanted an ovum, which he unexpectedly found in the tube, to the peritoneal cavity from which he had removed a fibroid, and he delivered a living child at term.

The postoperative course is often marked by fever. In the absence of peritonitic symptoms this may be ascribed to absorption of blood. Some operators, Zweifel, Bröse, Werth, *et al*, are careful to remove all the blood from the peritoneal cavity, believing that it has a toxic action. The practice is to leave a large portion of it, on the theory that it is partly reabsorbed and used up. I have never seen any harm from this treatment, which is recommended by Veit, Martin, Watkins, Ries, *et al*. Thies suggested to collect the blood in the peritoneal cavity, defibrinate it, mix it with Ringer's solution, and reinject it into the median basilic vein.

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## CHAPTER XXXI

### DISPLACEMENTS OF THE UTERUS

#### ANTEFLEXION AND ANTEVERSION

NORMALLY, the uterus is anteverted, and during the first months of pregnancy this anteversion is increased, the fundus lying heavily on the bladder (Fig. 110, p. 86). Pregnancy occurring in an anteflexed uterus displaces the fundus downward, also pressing on the bladder and diminishing its capacity, but in both instances the uterus is soon directed upward into the abdomen by the obtusely placed pubis, and incarceration does not occur unless adhesion or neoplasm locks the organ in the pelvis. Anterior displacements, according to Grailly Hewitt, cause hyperemesis gravidarum, and proper treatment is curative. In rare cases this is true.

Late in pregnancy the uterus always becomes anteverted, owing to the distention of the anterior abdominal wall. When this becomes pathologic, we call it *pendulous abdomen* (venter propendens, ventre en besace, Hängebauch), and in advanced cases the fundus may be inverted, pointing downward, and hanging between the knees. In primiparæ pendulous belly is very rare, and usually indicates the existence of a contracted pelvis, twins, or some condition preventing engagement of the fetal head. Occasionally, about the eighth month, the belly-wall gives way suddenly, the uterus falling forward. Striæ gravidarum are usually present in great numbers in these cases. One would naturally expect pendulous abdomen to be absent in athletic women and common in those of indolent habit, but the author's experience shows that both are equally affected. It is probable that a congenital weakness of the abdominal plates may exist and be causative of pendulous belly, as well as enteroptosis. Multiparæ suffer more commonly from this affection, and it increases with the number of children. The other factors are contracted pelvis, increased inclination of the pelvis, kyphosis, lordosis, spondylolisthesis, very large fetus, twins, polyhydramnion, frequent child-bearing, and tumors complicating pregnancy. Improper habits also cause weakening of the abdominal supports; such are constipation, wearing ill-fitting corsets or high-heeled shoes, carrying children or weights on the protuberant belly.

During pregnancy pendulous abdomen causes a sense of weight and distention, dragging pains in the loins, in the belly, and at the costal insertions of the recti, often frequency of urination, intertrigo of the lower abdomen and thighs, occasionally varices and edema of the vulva. The diastasis of the recti, which by the laity is called "rupture," may be so marked that the uterus falls forward, covered only by the peritoneum, a thin layer of fascia, and the skin, allowing the surface and the contents of the uterus to be felt with startling distinctness, and sometimes even the color of the organ showing through—*hernia uteri gravidi abdominalis*. In such cases locomotion may be hindered.

During labor pendulous abdomen may cause serious dystocia. The uterus is thrown so far forward that its axis forms an acute angle with the pelvic axis; the cervix is pulled up into the hollow of the sacrum, sometimes even above the promontory; dilatation is delayed, and the posterior uterine wall is overstretched. This, together with obstructed labor because of malposition of the fetus and disturbed mechanism, invites rupture of the uterus. Malpresentations, such as shoulder and breech, are common in these cases, because the head, in spite of strong pains, can not get down into the pelvis. Malpositions, especially anterior parietal bone

tion, are especially prone to occur, as can be seen in Fig. 353. Prolapse of the cervix and extremities may also cause dystocia, and, owing to the peculiar shape of the uterine tumor, diagnosis is difficult. In the child facial paralysis has been caused by pressure of the neck against the pubis, and the author found shortening of the sternocleidomastoid muscle, with temporary torticollis, as the result of the lateriflexion of the fetal neck. Should the shortened muscle tear during simultaneous labor or operative delivery and become inflamed, a permanent wry-neck result. The child is exposed to all the dangers of the abnormal mechanical labor, and the fetal mortality is, therefore, higher.

**treatment.**—Prevention accomplishes a good deal. The corset should be removed as soon as the fact of pregnancy existing is established, and the woman's

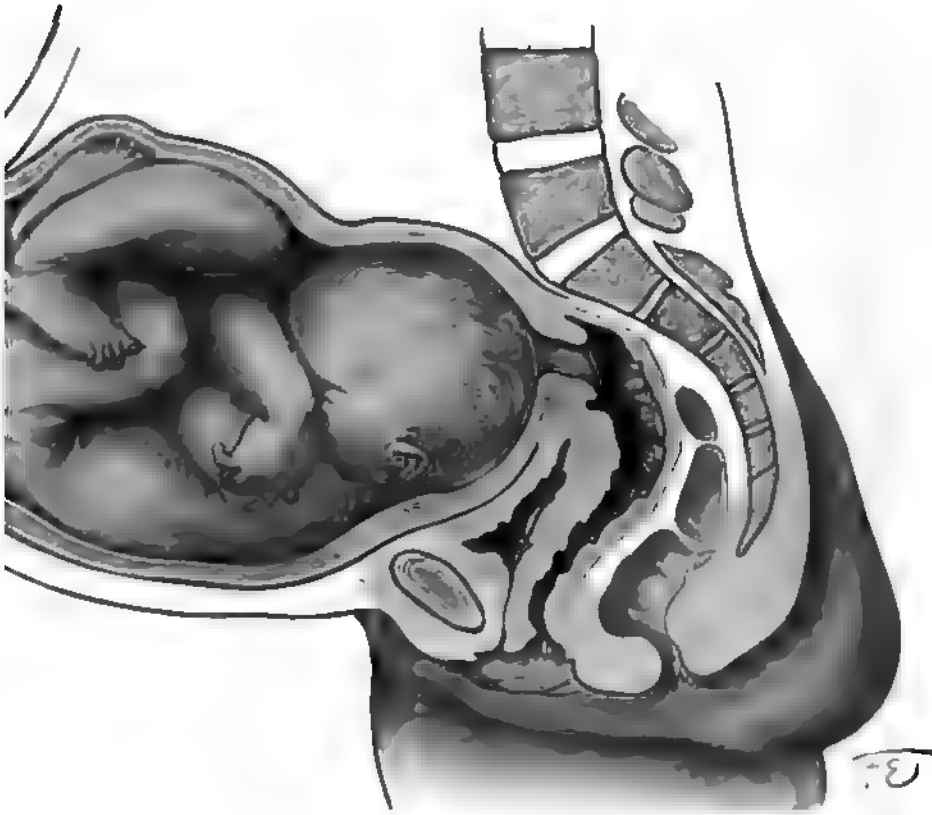


FIG. 353.—PENDULOUS BELLY.

could be ordered as is described under the Hygiene of Pregnancy. During the last few months of pregnancy the abdomen should be supported by a properly fitted binder. Most of the "maternity corsets" on the market exert pressure on the uterus in a downward direction, when the proper action is one of support from below. The ordinary surgical binder with straps over the shoulders meets the indication best, the principle being well shown in the supporter illustrated by Hirst (Fig. 4).

After delivery one should attempt to restore the tonus of the abdominal wall as far as possible by—(a) Prevention of the accumulation of gas and feces in the intestines (these keep the muscle overdistended); (b) preventing infection, which lames the abdominal wall; (c) keeping the patient recumbent for at least a week, and let-

ting her resume her household duties slowly; (d) using some sort of abdominal support after getting out of bed; (e) by systematic gymnastics and massage of abdominal muscles.

In cases of fully developed pendulous belly during pregnancy the binder illustrated should be worn as soon as the uterus rises out of the pelvis; the p

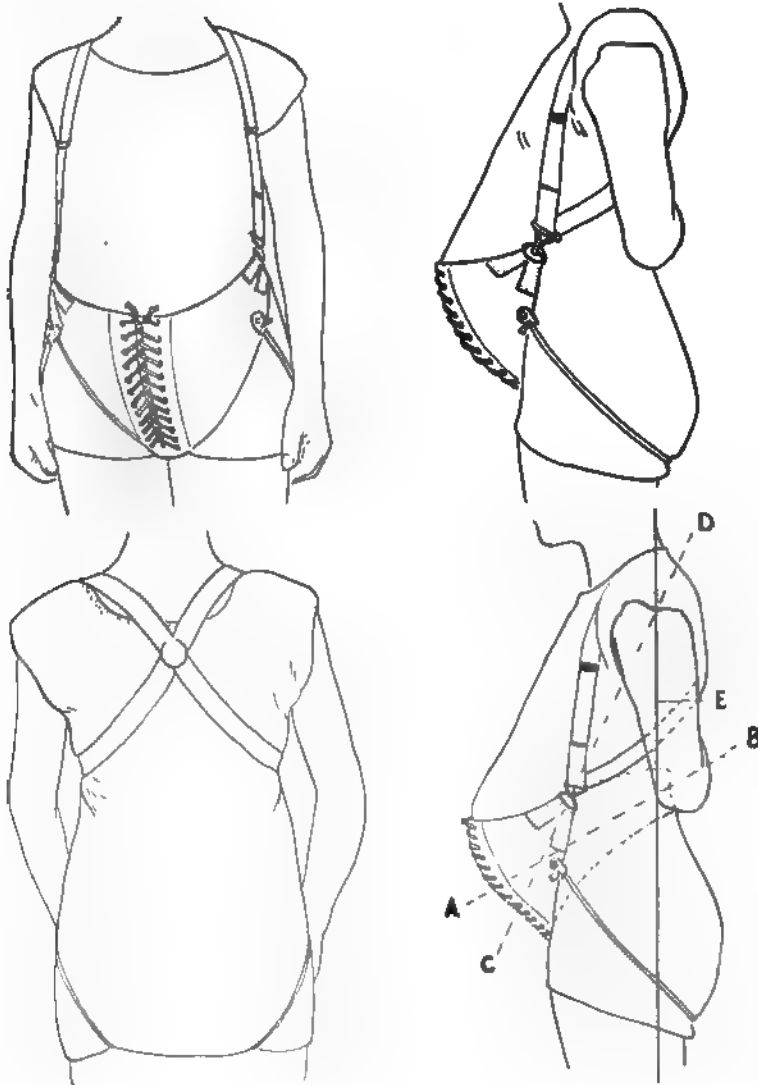


FIG. 354 —PATTERSON'S ABDOMINAL SUPPORTER.  
This gives the best principle of abdominal support (redrawn from Hirst).

should lie much on the back, and the physician should examine her in the last trimester to discover a malpresentation.

During labor the binder should be worn, or the uterus may be pulled up by a towel slung over the shoulders and held in place by another around the belly. In some cases it is best for the attendant to push the pendent fundus upward during every pain until the head enters the pelvis. The author has often accomplished this by letting the patient squat in an aboriginal attitude (Fig. 355). This procedure is also recommended by King. The thighs force the uterus up, and

rtion occurs in one-fourth of the cases and annoying bladder symptoms are the . Labor often comes on prematurely.

Labor is complicated by premature rupture of the bag of waters and prolapse of the cord; abnormal presentation, usually shoulder; slow, weak pains, or strong inefficient pains, because of the vault of the vagina being obstructed by the k septum; postpartum hemorrhage. All manipulations are rendered laborious because the uterine cavity is difficult of access, since the hand has to pass a crooked

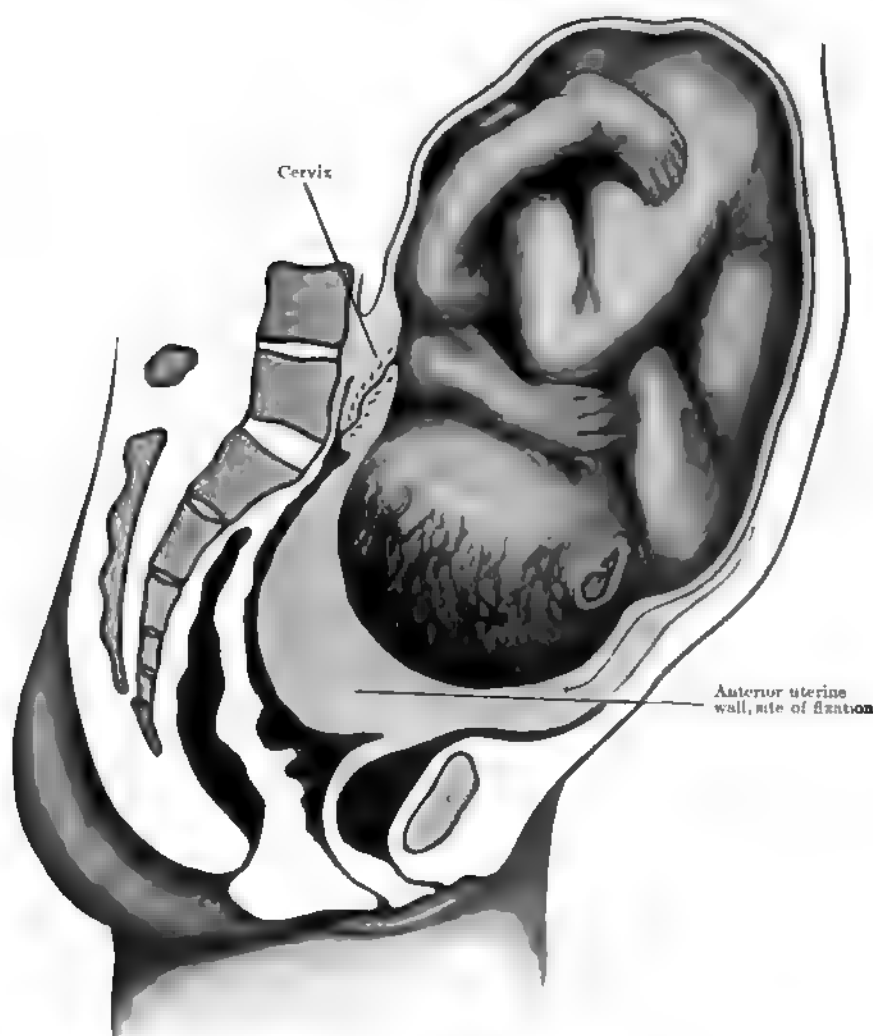


FIG. 356.—MRS. M. CONDITIONS AT TERM AFTER VAGINOFIXATION. CESAREAN SECTION.

al and then operate over the border of a ledge. Even the lateral posture does facilitate the operative procedures very much.

**Treatment.**—A woman who has had an operation fixing the uterus in an abnormal location requires careful watching during pregnancy. Annoying symptoms are only partly relieved. Threatened abortion requires rest in bed and opiates; if abortion occurs, the accoucheur must see that the uterus is absolutely empty, that the drainage of its cavity is good. As the woman nears term frequent

en emptied, and then, usually coming on more or less suddenly, retention of the urine. The bladder becomes enormously distended, containing, in one of the

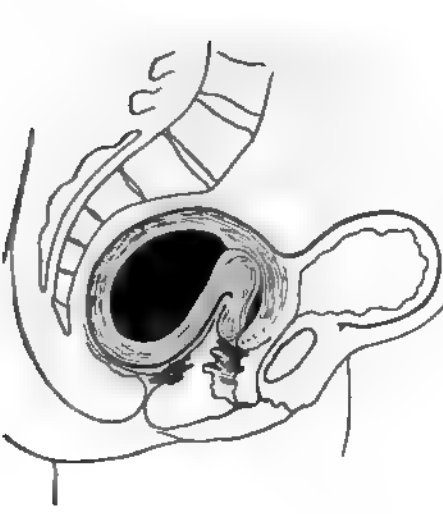


FIG. 357.—RETROFLEXIO UTERI GRAVIDI.

Arrows show the direction of development.

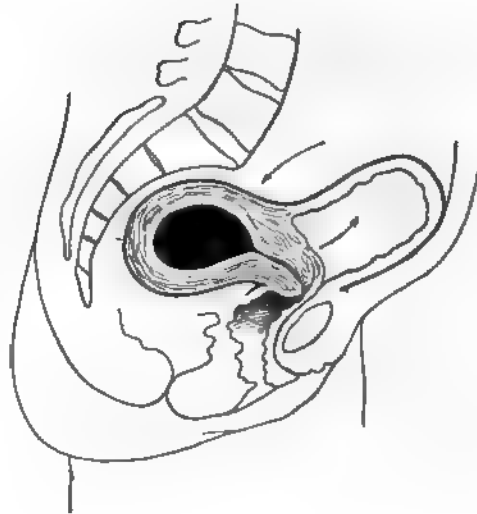


FIG. 358.—RETROVERSIO UTERI GRAVIDI.

Note differences in the cervix.

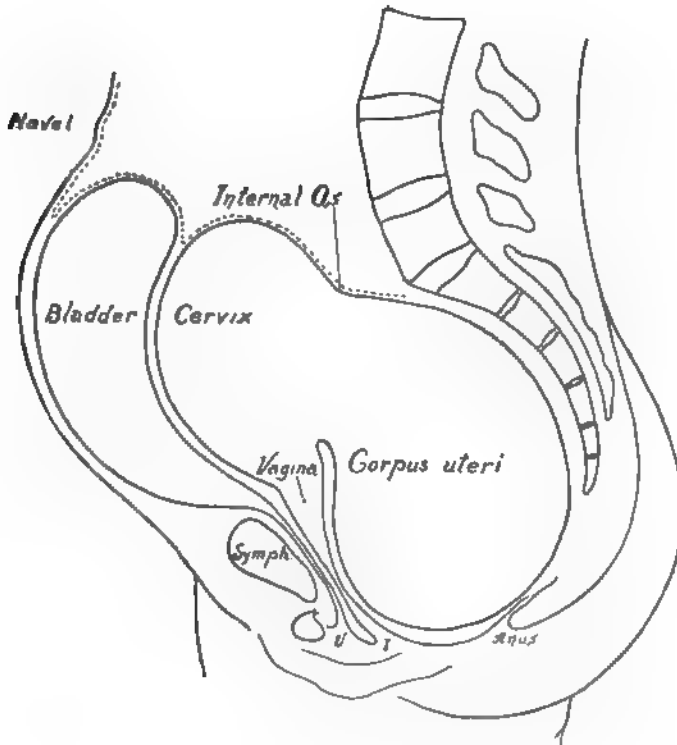


FIG. 359.—FRANK'S CASE OF PARTIAL INCARCERATION OF THE RETROFLEXED GRAVID UTERUS.

thor's cases, 96 ounces of urine, and in a case reported by Blundell, nearly two llons. Constant dribbling may occur, that is, retention with overflow—*incontin-  
tia* or *ischuria paradoxa*. There may be edema of the extremities. Consti-

pation and diarrhea are occasionally noted. Decided symptoms occur long before the room in the pelvis is entirely filled by the growing uterus, and usually bring patient to the physician. Rarely the woman waits until the uterus is tightly wedged in the pelvis. As a rule, the symptoms begin in the third month and case is terminated by the fifth, but sometimes the pregnancy has proceeded to eighth month, and in partial retroflexion, to term.

Four terminations of these cases are possible: (1) Spontaneous rectification; (2) abortion; (3) partial restitution; (4) incarceration.

1. Spontaneous rectification is the rule about the third or fourth month, fundus rising past the promontory and falling forward. Contraction of the muscular fibers of the anterior uterine wall, aided by the round ligaments, accomplishes



FIG. 360.—RETROFLEXIO UTERI.

A retroflexed uterus had been pushed up out of the pelvis by means of a colpeurynter in the fourth month, so pregnancy proceeded to term. Labor was normal, but because of hemorrhage the placenta had to be removed, which was difficult on account of its inaccessible location. The flexion of the uterus had persisted throughout.

this, and it is favored by putting the patient to bed, thus relieving the displacement of the abdominal pressure. The change usually requires some days or weeks but may occur rapidly in twenty-four hours or between two examinations. Prolonged adhesions may delay the restitution, but usually the adhesions, even when extensive, are stretched, torn, and even absorbed. If the adhesions are too strong, if the changes in the structure of the uterine wall are permanent, the uterus is distorted in the direction of the attachment of its wall, which portion is drawn sac-like, the balance of the uterus dilating to accommodate the ovum. Fig. 360 shows such a case. Spontaneous cure is commoner in retroflexion than in inversion, because in the former the corpus has a firm body to pull against—the cervix.

2. Abortion is a frequent termination of retroflexed pregnant uteri; in habitual early abortion is often caused by this malposition. The lack of room

not cause the abortion, but the uterine action is started by disturbance in the uterine and pelvic circulation, by chronic endometritis the result of the congestion, with hemorrhages in the decidua, and by chronic metritis, which perhaps was the original cause of the displacement. Owing to the strong contractions during the course of abortion, the uterus usually rises in the abdomen, thus hiding the cause of all the trouble, but aiding the emptying of the ovum and the lochial discharges. Rarely—and in these cases there are adhesions—the drainage of the uterus is incomplete because the fundus is lower than the cervix.

3. Incomplete restitution may result in a condition known as *retroflexio uteri partialis*. This term is applied to those cases where part of the fundus is retained in the pelvis, the anterior wall expanding in the abdomen to form the ovum container. Many forms of the uterus are possible. (See Figs. 359–361.) They are



FIG. 361.—SACCIFORM DILATATION OF THE UTERUS AT TERM.

due to inveterate adhesions, tumors, or to changes in the uterine muscle or serosa at the point of the flexion.

These cases may terminate normally at term, the deformity and dislocation of the cervix being finally overcome. Abortion or premature labor may occur, or incarceration which demands early interference, and if at term, operation.

A condition known as *sacciform dilatation of the uterus* may be confounded with partial restitution. The cervix is found behind or above the pubis; the culdesac is filled with part of the dilated cervix or the lower uterine segment (Fig. 361). It is usually a simple matter, by means of the finger or the vulsella, to pull the cervix to the median line, and then complete delivery in the natural or ordinary operative method, but Depaul, who wrote a good paper on the subject, was unable in his case to find the os, and the patient died undelivered, though he had made an opening through the posterior uterine wall.

4. Incarceration of the growing uterus in the pelvis is the most serious outcome, and the symptoms which demand interference come from the bladder. This organ cannot be emptied properly, becomes enormously distended, reaching even

—gain access either through the urethra or by the catheter, or from adherent pelvis. Anemia of the bladder from overdistention or rupture of one part of the vesica, with urinary extravasation between the layers, has been given as a cause of the necrosis. Death may result from urinary sepsis (Fig. 362).

The bladder claims our chief interest, but the bowel sometimes shows symptoms, such as tympany, constipation, and vomiting. Occasionally a mucous diarrhea occurs. Ileus is exceedingly rare.

Incarceration of the uterus may lead to abortion or to septic infection of the urine contents, the bacteria passing through from the bladder, or upward from the decomposing urine, which dribbles into the vagina continually. Perforation and rupture of the uterus, with death from peritonitis, have been noted to follow prolonged incarceration, and in rare instances the uterus was expelled through the rectum or through the posterior wall of the vagina, it and its contents being delivered

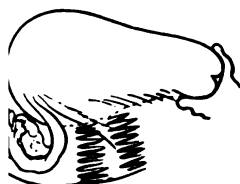


Fig. 363.



Fig. 364.



Fig. 365.



Fig. 366.

363-366.—MRS. F., PRIMIPARA. RETROVERSIO UTERI ADHERENTA WITH PROLAPSE OF OVARIES IN CULDESAC; PREGNANCY.

Some pain and irritation of bladder; attempted reposition in office at eight weeks failed; knee-chest position used daily with air into vagina; at three months could feel posterior wall drawn out and anterior wall bulging upward (in thin woman); spontaneous restitution at fourth month. The four figures indicated the process which took place.

side. Even very late spontaneous restitution of the uterus may occur, but we not wait for it in practice.

**Diagnosis.**—This is seldom difficult if a careful examination is made. Any pregnant woman giving a history of dysuria or dribbling urine should be examined for reflexio uteri. Abdominally, one sees and feels the distended bladder as an elastic mass not giving a good wave of fluctuation. If the bladder-wall is hypertrophied, the mass may be hard. After catheterization, which is invariably necessary, the enlarged abdomen is striking. Vaginally, one finds the cervix pressed upward against the pubis or even above the pubis, while the culdesac is filled with a soft mass which bulges into the vagina and may even (late) distend the perineum.

The differential diagnosis must be made from extra-uterine pregnancy, fibroid of the posterior wall, and incarcerated ovarian tumor. Concerning ectopic gestation, the reader is referred to the appropriate chapter, but here the warning may be repeated to be sure that one really has to deal only with a retroflexed uterus before attempting to replace it. Demonstration of the uterus alongside the tumor in the culdesac is needed to settle the existence of a neoplasm in the pelvis, but if the woman is pregnant and a neoplasm co-exists, the diagnosis is formidable.



## RETROFLEXIO UTERI GRAVIDI

1. Symptoms of incarceration early.
2. Bladder symptoms pronounced.
3. Tumor in question symmetric and soft all over.
4. There is no other tumor above the pelvis.
5. Moving the cervix imparts an impulse to the tumor.
6. The fornices are flattened, at least not drawn up.
7. The tumor in the culdesac may contract.
8. May distinguish fetal parts.
9. May outline the round ligaments per rectum.

## PREGNANCY WITH OVARIAN TUMOR

1. Absent or very late.
2. Absent or inconsiderable.
3. Usually asymmetric, hard, and tense all over or in places.
4. Often can feel the pregnant uterus above inlet and to one side.
5. The upper tumor (the uterus) can be moved independently of the tumor.
6. The fornices are drawn up high, sometimes even above the pubis.
7. Never.
8. Never.
9. Not positive (in one case strands simulated these).

Incarceration of a pregnant horn of a double uterus and partial retroflexion of the uterus both give diagnostic problems which may not be solved except by laparotomy, and countless mistakes have been made.

Dührssen, among others, emphasizes the differences between the clinical course and diagnostic findings in retroflexion and those of retroversion, but practically the two conditions are the same. Retroversion may, as pregnancy goes on, become a flexion; retroversion produces symptoms of incarceration later because the cervix, pointing toward the abdominal cavity, can develop in this direction; retroversion is less likely to reduce itself and is harder to correct artificially. In retroversion one finds the cervix pointing toward the navel; in retroflexion the cervix points toward the coccyx, and one feels the angle between it and the fundus.

**Prognosis.**—Most cases of retrodisplacement terminate by spontaneous reduction or respond easily to art, and nowadays, when women consult the physician so readily, a neglected case is a rarity. Gottschalk, quoted by Dührssen, collected 67 cases of death in which were 16 cases of uremia and exhaustion, 7 of sepsis, 18 of peritonitis, 11 of rupture of the bladder, 3 of pyemia, 2 of rupture of the peritoneum and vagina, 5 errors of art, 1 ileus, and 4 unknown. The danger of rupture of the bladder occurs both from overdistention and from brusque attempts to replace the uterus; the bladder has been punctured by the catheter and severe hemorrhage into it may result from too rapid withdrawal of the urine. The uterus may be torn by attempts to replace it, but the greatest source of danger is retention of urine, with cystitis, gangrene, or ascending infection, etc.

**Treatment.**—If the condition is discovered very early, one may wait a while to see what nature will accomplish. A gentle attempt to replace the uterus may be made at the first examination, and if successful, a hard-rubber pessary is introduced, to be worn until the end of the fourth month. Otherwise the patient is instructed to take the knee-chest position three times a day, and to sleep on the side, with the buttocks slightly elevated. If, after three weeks, the condition is unchanged or worse, the woman is put to bed, and a determined effort for cure is made.

First, the bladder must be emptied and kept empty. When the uterus is incarcerated this is not so easily done, because the urethra is very long, flattened, distorted, edematous, or the bladder itself divided into two compartments, only one of which is accessible to the catheter. Care must be taken to avoid producing a false passage, and a soft catheter is the best instrument. It may be necessary for the physician, not the nurse, to use a silver male catheter. Aids to catheterization are: Sims or knee-chest position; using the right sized catheter—No. 12 to No. 15 French scale; pushing up the fundus or pushing back the cervix with two fingers in the vagina; pulling down the cervix with a vulsellum (not recommended by author); allowing warm, sterile olive oil to flow through catheter while being inserted; extreme gentleness and much patience. If the retention has been great and prolonged, all the urine should not be withdrawn in one sitting, and the rate of flow must be very slow. After an interval of three hours the bladder may be

completely emptied, the reasons for this advice being that the sudden relief of so immense an abdominal distention and peritoneal stretching may cause shock, and the blood rushing into the anemic mucous membrane of the bladder may produce hemorrhage in it.

By saline cathartics and glycerin enemata, using small amounts of liquid, the bowels are kept free and tympany prevented.

Reposition of the uterus is usually easily accomplished after the bladder is emptied, and it is aided by employing the knee-chest position, by pulling the cervix down with a vulsellum (the instrument shown in Fig. 761 is better), and pushing the fundus upward and to the side. The fundus should be brought to slip alongside and avoid the promontory, by pressure with two fingers in the vagina or one in the

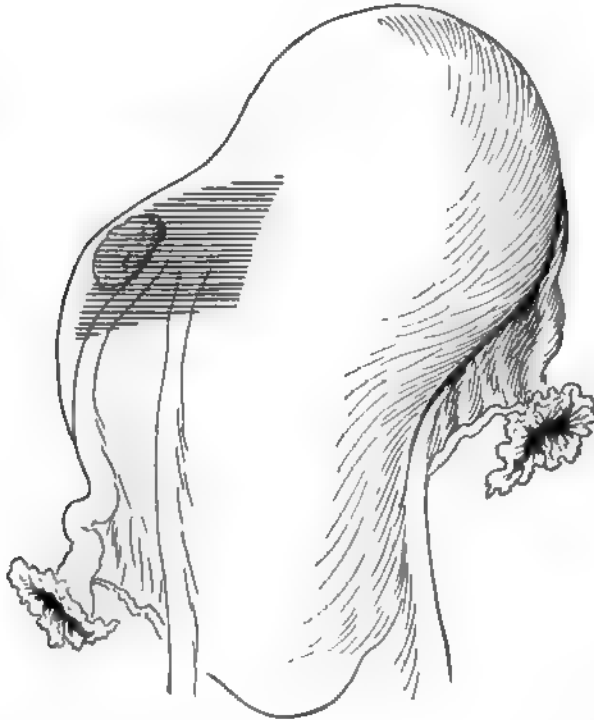


FIG. 367.—MRS. D., PRIMIPARA. SHOWING TORSION OF UTERUS FROM ADHESIONS.

Appendicitis with peritonitis four years ago; pain at frequent intervals throughout, and painful uterine contractions at end of this pregnancy; threatened abortion at three months, therefore rest in bed, troublesome tympany; labor at term; very severe pains and desire to urinate with each contraction; spontaneous delivery, boy, 8 pounds; incarcerated placenta, hour-glass contraction; hemorrhage; manual removal of placenta, which was partly adherent in left horn of uterus under the spleen, requiring introduction of hand nearly to elbow; uterus spirally twisted, remained open, filling with blood, tamponade; recovery. Uterus adherent to abdominal wall at point indicated by shading.

rectum, aided by anesthesia, and using great gentleness and patience. Too great force may rupture the uterus, may tear a vascular adhesion, may cause hemorrhage into the bladder or even burst it, and may bring on abortion. Women have died because of too violent manipulations. Even after reposition bladder necrosis may occur the damage having already been done.

If manipulation will not restore the uterus, one may temporize a short time, employing the following measures: (a) Knee-chest position every four hours for fifteen minutes, with continuous rest in bed on the side, with the hips elevated, and frequent emptying of the bladder and rectum. In the absence of symptoms of cystitis, and without retention, one may wait. Urotropin, 5 grains, medicinal methylene-blue, 1 grain, in capsule, are to be given four times daily in these cases; (b) a colpeurynter with 16 ounces of water is placed in the vagina, and the foot of the bed elevated 18 inches. Some authors recommend mercury to fill the colpeurynter.

One may continue these gentle efforts for several weeks until successful, but must not delay until cystitis or aggravation of the condition indicates their futility. Laparotomy has frequently been done and the uterus easily raised, the adhesions being broken up, or—and this seems to have been overlooked—simply by allowing air to get under the retroverted fundus. The belly is opened in the interests of the child, and is permissible only when the bladder is not gangrenous, and in the absence of symptoms of acute peritonitis—this because the protective adhesions around a gangrenous bladder may be ruptured, or the softened uterus may tear.



FIG. 368.—PROLAPSE OF CYSTOCELE AND RECTOCELE DURING LABOR.

The incision is to be begun high, at or above the navel, and then enlarged downward after being assured that the bladder is not in the way.

If conditions are not right for laparotomy, the uterus must be emptied, but, owing to the inaccessible cervix, this may be difficult. A sharply curved sound or mabougie may enable one to puncture the membranes, and during the resulting contractions the uterus will lift itself up and empty itself, or permit the accoucheur to do it. If one cannot reach the os, the puncture may be made through the bulge in the posterior uterine wall, using an aspirating needle and syringe. In one case Bum drew off enough liquor amnii to allow the replacement of the uterus, and abortion did not follow.

Posterior hysterotomy, with removal of the whole ovum in one sitting, may also be done, and reference to Fig. 361 will show that it is not always necessary to op-

the peritoneal cavity. If this operation is attempted and the culdesac opened, one should try to replace the uterus by combined manipulation before incising it. If successful, the pregnancy may go to term. To prevent recurrence the vagina is tamponed for several days and then a large Smith pessary worn until the uterus is too large to fall back.

Gangrene of the bladder is diagnosed by the discharge of foul urine, with flocculi of pus and shreds of membrane, in the presence of septic fever. Cystoscopically, very little can be seen, but the severe cystitis and localized necroses with hemorrhages may be found before gangrene has set in. As soon as the diagnosis of gangrenous cystitis is made the bladder is to be widely opened from the vagina, loose pieces of tissue removed, and freest drainage provided. Urotropin, alternating



FIG. 369.—ACUTE ELONGATION OF THE CERVIX AT EIGHT MONTHS (Chicago Lying-in Hospital).

with salol, is administered, 5 to 8 grains four times a day. Urinary infiltration of the perivesical spaces is to be sharply watched for, and on its discovery the whole region immediately and broadly incised, above or below the pubis, or both, and the freest possible drainage established. It is unsafe to open the uterus or induce abortion after gangrene of the bladder has begun because of sepsis; therefore it is best to drain the bladder and await developments. The uterus may be replaceable after a few weeks, or more safely attacked after the bladder has cleansed itself somewhat. When the uterus has become infected, it must be emptied, or, if this is impossible, extirpated. Nowadays these neglected cases are extremely rare, because the women consult the physician earlier.

Partial retroflexion of the gravid uterus requires treatment on similar lines if threatening symptoms arise. At term, if it is impossible to bring the cervix

into the axis of the pelvis, one may have to deliver through the posterior cervical wall or do an abdominal cesarean section.

**Distortion of the uterus**, by its adherence to the abdominal wall, to the sides of the pelvis, the rectum, etc., may give rise to serious dystocia, as has been seen in the instance of antefixations. Figs. 363 and 367 give diagrams of two cases recently under the care of the author, and the brief histories indicate the commoner complications and treatment.

### PROLAPSE OF THE PREGNANT UTERUS

**Procidencia** may occur in the very early months, and unless replaced leads to abortion, but Wimmer reports a case of a six months' gestation outside the vulva, and this, according to Braun Fernwald, is the only authentic one on record where the pregnancy was so far advanced. Relaxation and prolapse of the vagina, with partial prolapse of the uterus outside the vulva, are not very rare. They may occur during pregnancy as the result of severe trauma, because a tendency to prolapse existed before, or a prolapsed uterus may become pregnant. (See Findley.)

Spontaneous retraction of the prolapsed portion usually occurs, and after the fourth month

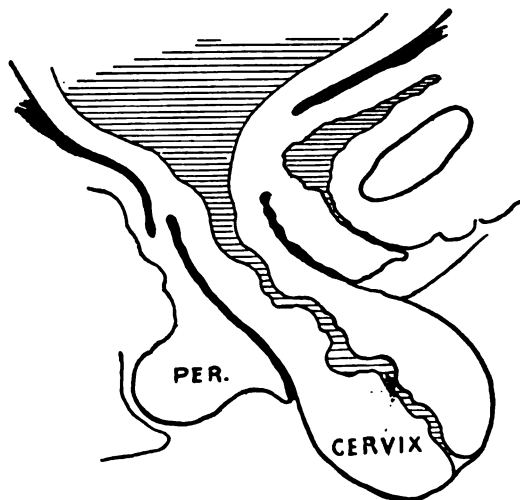


FIG. 370.—HYPERTROPHIC, EDEMATOUS, AND PROLAPSED CERVIX IN PREGNANCY.  
Diagram of internal findings of Fig. 369.

the tendency to fall disappears; indeed, the patient may feel better during pregnancy than at other times, since the uterus is in place. If spontaneous reduction does not take place, it is a simple matter to return the womb and hold it in position by tampons or an air pessary until it is too large to come down. Ulcerations of the cervix are to be cauterized with 10 per cent. silver nitrate and all infections cured before labor starts in. Rest in bed, 1:3000 permanganate douches three times daily, and roborant diet will accomplish this.

An irreplaceable, completely prolapsed uterus is to be emptied.

**Extrusion of cystocele and rectocele** during pregnancy is a very annoying condition, the exposed parts sometimes being eroded, usually varicose, and occasionally inflamed. Pruritus may be obstinate, and the author has observed several cases of mycosis vulvæ under these conditions. Rest in the horizontal position is to be advised, also extreme cleanliness.

Eversion of the vaginal walls occurs in multiparæ in the second stage, during the strong bearing-down efforts, especially if the cervix is rigid and does not retract above the head (Fig. 368). The cervix may appear outside the vulva as far as one or even eight inches, and will not go back under pressure. Delivery is more or less difficult, depending on the degree, but usually possible, though many of the children die. If labor has to be operative, two assistants should hold back the edges of the cervix and the everted vagina with specula while the delivery is being effected.

Hirst collected 27 cases of *vaginal enterocele*, to which the author can add one, occurring in the service of the Chicago Lying-in Hospital Dispensary. Here the hernial opening in the posterior culdesac was 2½ inches across, but the coils of the intestine could be very easily replaced. The treatment of cystocele and rectocele during labor is symptomatic, the parts being replaced as much as possible and held back with the fingers so that the advancing head can slip through the space thus provided.

**Hypertrophic elongation** of the cervix rarely complicates labor. Conception is hindered and dysmenorrhea usually calls for treatment, the cases seldom coming to the accoucheur until

They have been operated on. Sometimes the scarred cervix gives trouble. In one case the author amputated three centimeters of a long cervix, which, even as late as the fourth month, the time the operation was done, was visible at the vulva. Ulceration and possible infection were the reasons for interference. Labor was uneventful.

Acute enlargement of the cervix with edema, described first by Gueniot in 1872, and of which Jolly, in 1904, was able to collect 10 cases, is quite a rare occurrence during pregnancy, labor, and the puerperium. The author can add one case occurring during pregnancy as the result of a sudden violent strain (Fig. 369). The fornices of the vagina were normally placed, and there were no bladder symptoms. Several days had elapsed since the accident, and the exposed portion of the cervix was dry, cracked, and partly eroded. It was disinfected, replaced, and retained by a

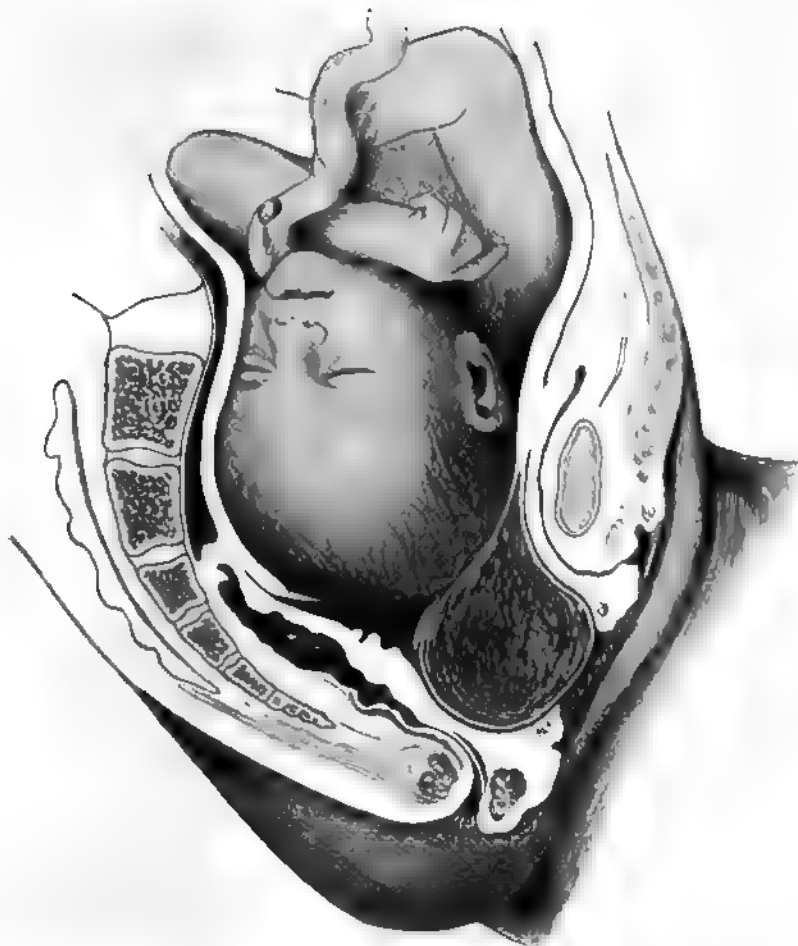


FIG. 371.—EDEMATOUS ANTERIOR LIP OF CERVIX, CAUSING DYSTOCIA.

tampon; the prolapse did not recur, and labor was normal. Williams refers the condition to an angioneurosis, but in most of the cases a history of injury has been obtained.

During labor, when the head is arrested high up, the cervix becomes swollen and may prolapse as a dark-blue, hemorrhagic, edematous mass (Fig. 371). The protuberant cervix is to be tenderly pushed up and held in position during the pains. Soon the head slips down past it. During forceps delivery it must be held back with two fingers during each traction. It may require incision. A contracted pelvis should be thought of as the cause.

Hernia of the gravid uterus in the inguinal canal, through the umbilicus or abdominal wall, and diastasis of the recti, allowing an actual hernial protrusion, have been observed.

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## CHAPTER XXXII

### ABORTION AND PREMATURE LABOR

It is said that almost half of the child-bearing women have had a miscarriage before the thirty-fifth year. Hegar said that there is one abortion to eight labors, but in all probability it is more frequent than this. In the author's private obstetric practice 24 per cent. of the women gave a history of abortion, which is probably below the actual. A specialist's practice does not represent the ordinary run of cases, because so many of his patients are primiparæ or women who have had difficult confinements or miscarriages before.

Stumpf and Franz collected large statistics, but they are of questionable value, as, indeed, are nearly all statistics, because one cannot get complete information. Hospital figures do not represent the conditions of private practice, because complicated cases are sent to the hospital, and statistics from both sources are, therefore, invalidated. Further, many abortions occur in the first weeks and pass under the diagnosis of delayed or profuse menstruation. Finally, very many abortions are deliberately concealed. In general, regarding abortion it may be said that it occurs more frequently in multiparæ than in primiparæ, perhaps because there are more multiparæ, but probably also for other reasons; oftener in the city than in the country, because of the prevalence of gonorrhea, the easy accessibility of the abortionist, etc.; oftener among the lower classes—but criminal abortion is probably more frequent in the educated classes; more frequent in the first three months of gestation, and, of the three, commonest during the third month; more frequent after the thirtieth year. Race, civil state, and color seem to have no influence.

The reasons for the more frequent occurrence of abortion from the eighth to the twelfth week are: The ovum is not strongly attached, and is weak and susceptible to outward influences; marked changes are going on in its circulation; since the woman is not sure of her pregnancy, she takes no care of herself; the women consider it no crime to get rid of the ovum before "quickening," and think abortion not dangerous in the early months.

Much disagreement exists regarding nomenclature. Miscarriage is a term used by the laity for every interruption of pregnancy before term, and the word "abortion" is resented as implying a criminal process. In scientific description it is best to drop the former and retain the latter. "Immature labor" has been used to designate the interruption of pregnancy from the sixteenth to the twenty-eighth week, and "premature labor" from then on, the term abortion being limited to the period before the sixteenth week. The author agrees with those writers who apply the word *abortion* to all interruptions of pregnancy before the child is viable, that is, before the twenty-sixth to the twenty-eighth week, and the expression *premature labor* to those terminations of gestation after the child is viable, but before term.

**Causation.**—A study of the etiology of abortion has very great importance as an aid to science, of treatment, of the prevention of subsequent accidents, and medicolegally. Therefore in all cases the accoucheur should search carefully for the underlying cause and make a note of all his findings.

A classification of the causes must be arbitrary, since they are very numerous and interact on each other. They are fetal, maternal, and paternal.

*Fetal.*—Death of the fetus always brings on abortion, and every fatal anomaly of the fetal body or its appendages is, therefore, an etiologic factor. Mall says one-third of aborted fetuses are teratologic.

*Diseases of the Chorion.*—Hydatidiform degeneration almost always interrupts pregnancy, a few cases being on record as having gone to term. Hemorrhage is usually furious when the fetus attempts to empty itself.

*Placental Diseases.*—Syphilis, hypertrophic endarteritis, excessive white infarct formation, plexies of the placenta, placenta prævia.

*Diseases of the Cord.*—Torsion, knots, stenosis, which latter is usually located at the placental navel insertion.

*Diseases of the Amnion.*—Acute polyhydramnion, oligohydramnion, amniotic adhesions to the fetus, causing its death.

*Diseases of the Fetal Body.*—Anomalies of growth; congenital weakness from ill parents, alcoholism, anemia, saturnism, tobacco, etc.; single and double monsters (rather commonly met, and they would be oftener discovered by proper search); acute infectious diseases—typhoid, recurrent fever, malaria, measles, scarlatina, cholera, etc.; chronic infections—tuberculosis, syphilis (usually after the fifth month); asphyxia of the child from low blood-pressure (anemia, syncope, shock) or from hemorrhages into the placenta in nephritis of the mother—hypertension placenta; insolation, continuous high temperature being most dangerous; sudden high temperature is also dangerous, but the fetus tolerates a gradual rise better (Runge); toxemia, whether autogenic or exogenic, under the former being hyperemesis gravidarum, chorea, eclampsia, etc.; under the latter, alcohol, tobacco (especially noticeable in cigar-makers), lead, carbon monoxide, etc. Infection of the fetus, acquired via the blood of the mother, the latter being apparently well, is a frequent cause of abortion. Pierrepont believes that toxins coming from septic discharges of the mother's mouth can cause abortion and premature delivery.

How does the death of the fetus cause abortion? (1) The ovum does not become a foreign body and stimulate the uterus to effect its expulsion, because the uterine connections may be kept up for months and the chorion be so well nourished that it grows. If the ovum were destroyed, this explanation would hold. (2) When the fetus dies, the stimulation of the growth of the ovum ceases and the alteration of the endometrial reflex brings on abortion—purely hypothetical. (3) The fetus develops a hormone, which, reaching the blood, inhibits uterine action, failing which, abortion results; the corpus luteum does not grow after fetal death, and its sustaining influence is lost—hypothetical.

Between the death of the fetus and its expulsion a period varying from a few hours to days, weeks, or months may elapse. This is called *missed abortion*. Pieces of placenta may remain in the uterus as long as nine months (author) and even months (Playfair). Ries found villi sixteen years after.

*Maternal Causes.*—Next to criminal interference chronic endometritis is the most frequent cause of abortion, and especially of the habitual early interruption of pregnancy. It acts by predisposing to hemorrhages in the decidua which kill the fetus or stimulate uterine contractions; by rendering the uterus irritable and intolerant of the fetus; by raising barriers against the growth of the placenta; by not allowing the ovum to obtain a solid nidus or a well-located one (placenta prævia). The bacteria in the endometrium or in the cervix may invade the ovum and kill the fetus. Endometritis of the decidua glandularis produces a condition called *hydrops gravidarum*, attended by sudden periodic discharge of accumulated secretions, and on one of such occasions the uterus may be urged to action. Acute gonorrhea and peri-uterine infection, for example, salpingitis or appendicitis, occasionally interrupt gestation.

Chronic metritis is the usual accompaniment of endometritis, and renders the uterus still more intolerant of gestation—the “irritable uterus” of the older writers. The uterine muscle cannot hypertrophy and expand as it should.

Malformations and diseases of the uterus, infantilism, single or double-horned uterus, fibroids, polypi, lacerations of the cervix, especially with coincident cervicitis or endometritis, amputated cervix—all are sometimes causative. Retroflexion of the uterus or retroversion have already been referred to as frequent causes of abortion; indeed, sometimes when abortion is threatened replacement of the uterus allows gestation to go to term.

Acute infectious diseases of the mother often cause abortion, as was said, through the disease passing over and killing the fetus, but they act also by causing an endometritis which shows a strong tendency to become hemorrhagic. The sudden rise of temperature may stimulate the uterus to action, as also may the hypercarbonization of the blood in those diseases which are attended by cyanosis—for example, pneumonia. Hemolysis also affects the fetus through the anemia of the mother.



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treatment, of course, will cut the process short, and a living healthy child is delivered at term.

Chronic endometritis is more frequently a cause of repeated early abortion than in the later months, and it is not seldom combined with uterine displacement. Each abortion aggravates the endometritis, a "vicious circle" being established. Laceration and amputation of the cervix sometimes prevent carrying a fetus to term, as do fibroids and infantile uterus also.

The author believes that infection of the ovum, as was above described, is at the root of much fetal pathology and may be active here too.

Nephritis, diabetes, or constitutional disorder, such as anemia, hypothyroidism, should always be searched for in these cases. The influence of the father may not



FIG. 375.—WHEN THE NAKED OVUM, SHOWN BELOW, IS EXPELLED, ALL THE DECIDUA ARE LEFT IN THE UTERUS.



FIG. 376.—CERVICAL ABORTION. THE OVUM STILL IN THE REFLEXA AND THE PLACENTA DRAWN OUT, BUT ADHERENT AT ITS BASE.

be forgotten. He may have gonorrhea, which keeps up a cervicitis or endometritis. He may not be capable of procreating a viable child. Chronic lead-poisoning is well known to have such an effect, and probably other poisons, especially alcohol, have similar action. Stockard has proved in guinea-pigs that the evil effects of alcohol may be transmitted to the third generation. Finally, there is a class of cases where none of the preceding conditions can be found, yet the woman cannot carry a child through to term. With improved diagnosis—*e. g.*, Wassermann reaction—the number of such instances is becoming rarer. (See Chapter LXXV, Induced Labor.)

**Mechanism.** As in the description of the mechanism of labor, in abortion we also discuss three factors—the powers, the passages, and the passengers. Uterine

accomplishes nearly all the work of abortion except the expulsion of the ovum from the vagina, which the abdominal muscles do. The bony parts practically never come into consideration, and the soft parts very seldom, the ovum plays an important part. In the first two months the decidua is vascular, and friable, the ovum small, soft, and compressible. It requires considerable effort by the uterus to separate and expel the former, while the latter slips out unobserved. From the eighth to the twentieth week the placenta is the main rôle; it is relatively large, separates with difficulty, especially from the uterine cornua, and such removal is usually attended by profuse hemorrhage. After the twentieth week the fetus is the most important passenger, and the character of the labor resembles more and more that at term. Separation of the ovum from the spongy layer of the decidua, and since the regressive changes—the involution—have not progressed far, this is often incomplete, and pieces of membrane and placenta are likely to be retained, especially in the tubal corners. One may, therefore, distinguish three fairly well-defined periods:

*First Period.*—In the first six to eight weeks the whole ovum is usually born, covered by the decidua, and it is often possible to reconstruct the conditions which existed in the uterus, as in Figs. 372, 373, 374. An ovum may be expelled naked, as in Fig. 375, or covered



—INCOMPLETE ABORTION—THREE MONTHS. The fetus only is expelled, all the secundines remain in the uterus.



FIG. 378.—PLACENTA PROTRUDING POLYPOID INTO VAGINA AND PARTLY ATTACHED, INVITING SEPSIS. THICK DECIDUA STILL IN UTERUS.

portions of the decidua. Whenever the ovum alone, covered by the shaggy villi, is expelled, one must conclude that the decidua still remain in the

uterus, and will require another effort of nature, which is often attended by profuse hemorrhage. In a few cases the decidua dissolve and come away in pieces in the lochia. Should the external os, as in primiparae, offer resistance and not dilate, the ovum is arrested in the distended cervix, the internal os closing. This was called cervical pregnancy by Rokitansky, but a better term is cervical abortion (Fig. 376). Simple dilatation of the constricted os is sufficient to liberate the ovum. True cervical-isthmal pregnancy occurs (Devraigne).

*Second Period.*—Several courses are taken by the abortive process during the third and fourth months. First the whole ovum is expelled—the fetus in an intact sac and a large part of the decidua covering it. This may be called the typical course, and offers the best prognosis for the mother, since hemorrhage is usually mild, interference is seldom necessary, and the remains of the decidua come away with the lochia.

Second, the membranes rupture, the fetus is extruded, the cervix closes, and the uterus has to make a second effort to expel the secundines (Figs. 377 and 378). During the interval, owing to partial separation of the placenta, hemorrhage is profuse, infection of the placenta may occur, and interference of some sort is usually necessary, all of which cause a worse prognosis.

Thirdly, the decidua reflexa and the chorion break, allowing the fetus in the amniotic sac to escape. A beautiful specimen is here shown (Fig. 379). The accoucheur must remember that the uterus still contains the placenta, chorion, and decidua.

In abortion the uterine contractions act the same as in labor, and dilatation of



FIG. 379.—FETUS IN AMNIOTIC SAC INTACT.

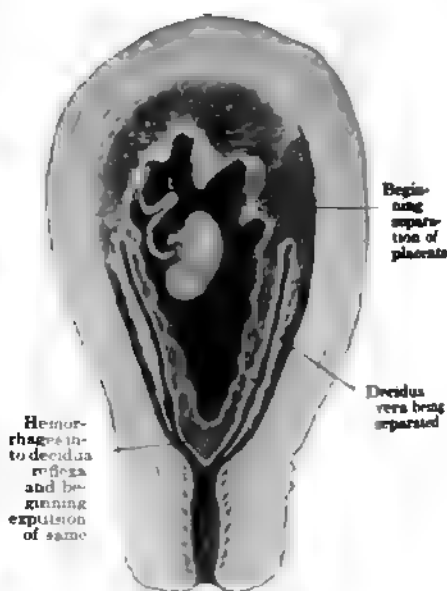


FIG. 380.—BEGINNING ABORTION AT SIXTH WEEK.

the cervix is produced in the same way, but, owing to the vascularity of the decidua, hemorrhage occurs as soon as the contractions begin, because the decidua loosens from the uterine wall. This separation begins at the cervix, proceeds to the fundus (Fig. 380), being latest in the tubal corners. Hemorrhages into the decidua and into the ovum occur and aid in the separation. Upon the delivery of its contents the uterus contracts down on itself and involution begins. This is slower and more likely to be incomplete after abortion than after labor at term. After-pains are sometimes observed, and milk not rarely appears in the breasts. In abortion, even before the fifth month of gestation, there may be considerable engorgement of the mammae.

Abortion after the fifth month is really a labor in miniature, and needs no other description. Breech and abnormal presentations are commoner, and the whole ovum is not seldom extruded intact. Expulsion of an unbroken ovum is very rare in the last months of pregnancy.

**Symptoms.**—Clinically, we speak of three forms of abortion,—*threatened*, *in progress* or *inevitable*, and *incomplete* abortion,—but four classic symptoms are present with all. These are: uterine pain, uterine hemorrhage, softening and dilatation of the cervix, presentation or expulsion of all or parts of the ovum.

*Threatened abortion* is indicated by a bloody discharge from the uterus, and sometimes by slight drawing pains in the back and pelvis, similar to menstrual sensations. The blood may come with a gush or ooze, or appear as a brownish, sticky mucus. Pain may be a slight symptom, or there may be only a sense of weight in the pelvis. On vaginal examination the uterus may feel harder than normal, which is because it is contracting. Softening and dilatation of the cervix seldom occur in threatened abortion, but the author has had several cases where the cervix was so relaxed so that the finger felt the lower pole of the ovum, and yet, after subsidence of the symptoms, the pregnancy went to term. An abortion may appear threatening for hours, days, or even months, and yet pregnancy go to full term. Again, suddenly, profuse hemorrhage occurs, pains set in, and the process becomes inevitable.

*Abortion in progress* presents the same symptoms, but the hemorrhage is heavier, the pains stronger and more regular, resembling those of labor. Softening and dilatation of the cervix proceed from above downward, and the shortening of the neck of the womb is easily followed by the finger in the vaginal fornices, or, when the os is opened, inside the cervix, at which time also the ovum or the edges of the parietal decidua may be felt. The symptoms vary, of course, with the mechanism of the abortion.

If the whole ovum is expelled complete in one effort of the uterus, the hemorrhage is usually moderate, and the pains cease as soon as the ovum escapes from the cervix. In multiparæ, because of the open cervix, the abortion is easier and quicker than in primiparæ. If the decidua remains, it is dissolved and comes away with the profuse lochial discharge, sometimes giving it an offensive odor, but seldom causing fever, though it may leave behind a chronic thickening of the endometrium.

If the membranes break, the fetus escaping naked or clothed only in its amnion, the remainder is expelled after minutes or hours, or, because of the profuse hemorrhage which usually occurs, the accoucheur has to interfere and clean out the uterus. Hemorrhage and pains may cease in the interval, during which time the case is called one of incomplete abortion.

*Incomplete abortion* means that the process has started, but that the uterus is not entirely rid of its contents. This does not include the retention in the uterus of a whole but dead ovum—which is “missed abortion.” Incomplete abortion is a dangerous condition, because of its immediate and remote bad sequelæ: (a) The cervix partly closes after the escape of the fetus, and the placenta, membranes, and thick decidua gradually break down and are discharged in the lochia. In these cases the lochia are profuse and bloody, sometimes with an odor, and continue thus until the last vestige is removed. Chronic endometritis is almost always the final result of such a process (Fig. 381). (b) A complete interval of rest may be afforded until, after hours, days, or even months, the uterus suddenly expels its contents. (c) Decomposition sets in, the pieces soften and are exfoliated, a layer of granulations separating the live from the dead tissue, or the bacteria break through this barrier, sepsis and sometimes death resulting. (d) A placental polyp is formed, the attached portion of the placenta being well nourished, layers of fibrin being deposited and organized on the outside until a pedunculated tumor is created, which may protrude from the cervix. Syncytioma malignum is not so common in these cases as in hydatid moles.

**Diagnosis.**—*Threatened Abortion.*—If the fact of normal pregnancy is known,

uterine hemorrhage and uterine pains signify that interruption of gestation threatens. It is not easy to diagnose early pregnancy when the uterus is contracting, because then it stimulates other conditions, for example, fibroid, chronic metritis, ectopic ovum. On bimanual examination the large, contracting and relaxing uterus, the beginning softening and shortening of the cervix, and the bloody discharge show that some abnormal process is going on. The rule is to treat every case of hemorrhage, after a period of amenorrhea occurring in a woman capable of reproduction, as one of abortion.

Differential diagnosis must be made from ectopic gestation, hemorrhage from cervical erosions (not rare), varices (very rare), hydrorrhœa gravidarum, and, in addition, all the conditions not associated with pregnancy, for example, neoplasms and malpositions. When pregnancy and threatened miscarriage are associated with a neoplasm, truly complicated conditions are presented for differentiation.

*Inevitable abortion* is more easily determined—the cervix is shortened, its angle with the corpus straightened, the external os dilated, allowing the finger to feel the ovum, and pieces of the decidua or of the ovum are expelled; hemorrhage is more profuse, the bag of waters ruptures, and painful uterine contractions are usually present. These signs enable us to say that an abortion is inevitable, but in rare instances the cervix may close, the hemorrhage ceasing, and pregnancy goes on to term. The discharge of decidua is usually considered positive evidence of an unavoidable abortion, but the author had one case of double uterus where the decidua was discharged from one side, the other being pregnant. The rupture of the membranes may be simulated by hydrorrhœa gravidarum, or graviditas examnialis (q. v. p. 534). After pregnancy is determined the differential diagnosis in abortion has to deal only with ectopic gestation, and the latter must always be taken into consideration. Rarely the extrusion of a fibroid or a polyp simulates an abortion.

*Incomplete Abortion.*—Is the uterus empty? Here the history of the passage of the fetus or of portions of the placenta may be useful, but unless the parts have been seen by competent eyes, the information must be questioned. We decide that something is left in the uterus when a woman who has had an abortion continues to have irregular hemorrhages, with or without pains, or discharges bloody lochia, with occasional clots or bits of tissue, for a long time. Examination will reveal a large, soft, subinvolved uterus, which sometimes contracts, with a succulent, patulous cervix through which the finger feels shreds of decidua, placenta, or clots. Microscopic examination of discharged or cureted pieces of tissue may show chorionic villi. In some cases the diagnosis as to whether the uterus is empty or not may be impossible without a curetage. The differential diagnosis must be made from subinvolution, endometritis post-abortum, ectopic gestation, fibroids, chorio-epithelioma, polypi, and occasionally the diagnosis of a previously existing pregnancy comes up. Even the microscope may fail to settle the question. The cureted material may show large and convoluted uterine glands (Opitz), but these are not pathognomonic. Hyaline degeneration of the uterine vessels gives more positive information, and now we have Abderhalden's test to help.

**Prognosis.**—Few women die from hemorrhage during abortion because, if the bleeding is marked, the patient faints and clotting stops the small blood-vessels. It is much different at term. If the hemorrhage is long continued, the unavoidable small loss during the abortion may prove fatal. Death is usually due to infection introduced from without, for example, by the criminal abortionist or by the physician through a lack of asepsis. It must be remembered that coitus can cause infection of the uterus, which results in abortion, and may be followed by fatal septicemia. It is usual, however, in cases of septic abortion, to suppose that an abortionist has been at work. If the uterus has been perforated and sepsis results, death is the more common termination.

The prognosis as to health is worse than after labor at full term. Involution is slower, lasting several months, and if infection has occurred, the uterus may never

normal again, but remains the seat of chronic metritis and endometritis. Endometritis post-abortion (Fig. 381), characterized by the prolonged persistence of clots of decidual cells and hypertrophy of the mucosa, is a frequent sequel of abortion, as is also pelvic peritonitis or cellulitis. In after years women who have had one or several abortions come to the gynecologist complaining of backache, sterility, and leukorrhea, and the examination shows a large, hard uterus, hypertrophied cervix, a retroversion or retroflexion, thickening of the broad ligaments, and tenderness along the sacro-uterine folds. Such women may be invalids for years or require capital operations in order to be cured.

**Treatment.—Threatened Abortion.**—It is inadvisable to examine a woman threatened by abortion because of the danger of aggravating the uterine contractions or causing hemorrhages to separate more of the decidua and ovum; therefore examination is done only when a thorough diagnosis must be made, and then with the greatest gentleness. Rest in bed is the best treatment, and morphin may be given to procure absolute quiet of patient and uterus. Laudanum in 20-minim doses every four hours will usually suffice, but it may be necessary to give more, watching carefully the action of the drug. The bowels are not disturbed for the first three days, then castor oil is given, its action being anticipated by an olive-oil clyster, the latter to avoid the patient's straining to evacuate hard feces. If the bleeding ceases, the patient may be allowed more freedom in bed, and after five days may get up, but should resume her activities very slowly, returning to bed on the slightest flow of blood; if the bleeding continues, a bimanual and specular examination is made, and if the cervix is inflamed and eroded, applications of nitrate of silver (10 per cent.) and douches of permanganate of potash, 1:3000, are ordered. If the bleeding recommences every time the patient becomes at all active, the abortion is inevitable, a mole having probably been formed. One may not allow repeated hemorrhages to debilitate the woman. The author, in several cases of placenta previa near term, has obtained a history of hemorrhages in early pregnancy.



FIG. 381.—ENDOMETRITIS POST-ABORTUM.

How long to wait in these cases where small repeated hemorrhages occur is not easy to decide. If the local findings point to molar formation, one should not wait, but if the child is presumably alive, one will try to save it. Rest in bed, uterine sedatives, horse serum, human serum should be employed to stop the bleeding, and frequent blood-tests made to be sure that the patient is not becoming dangerously anemic.

**Inevitable Abortion.**—Much difference exists in the treatment of abortion in progress as practised by different authors, and, indeed, no one plan will apply to all cases. A method that is ideal for the first twelve weeks must be modified toward the end of the fifth and sixth months, and again different conditions are presented for treatment, as may be seen by reverting to the pages on the Mechanism

always supervene, which means that the uterus is trying to expel its contents. No medicine should be given to allay this pain, nor does the author use ergot or pituitrin,



FIG. 383.—AUTHOR'S UTERINE CURET.

This is half sharp, the shank is flexible, and a ring is inserted in the handle, so that the instrument may be held securely and at the same time delicately. All curets are dangerous and should be used with the same care as a scalpel.

which are recommended by some. Often the pains cease suddenly, and one surmises that the uterus has emptied itself above the tampon. A convenient hour is selected



FIG. 384.—CURETAGE WITH FINGER. THE FINGER EXCELS ALL INSTRUMENTS.

for the removal of the tampon, but preparations should have been made for curetage under anesthesia if this should be found necessary. Often the entire ovum is found lying on the tampon, its separation having been aided by the damming back of the



blood, and its expulsion having been accomplished by the uterine contraction. All that is needed in such cases is to go over the uterus lightly with a half-sha curet, to make certain that pieces are not retained—especially in the tubal cornu. Some authors advise against this curetage, but the writer does it in all cases, believing that the patients make quicker and completer recoveries when the uterus is left absolutely smooth and clean. Without doubt much damage is caused by the curet in the hands of an unskilful practitioner, but this is no reason for condemning it—rather should we seek to qualify the practitioner to use all safe means for the patient's benefit.

If, when the packing is removed, the cervix be found still closed, it is best to tampon again and empty the uterus on the following day. Forcible dilatation of the

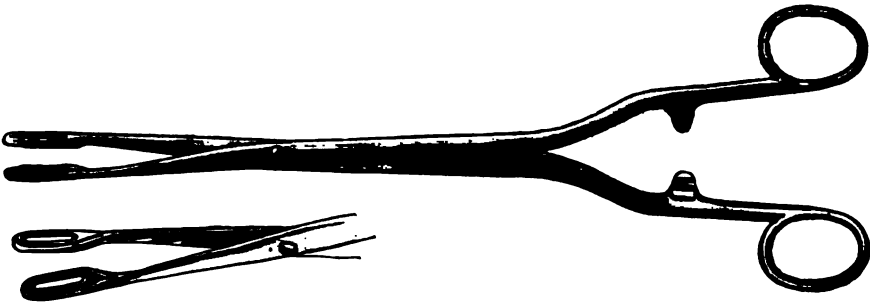


FIG. 385.—SQUEEZING OUT THE LOOSENED CONTENTS OF THE UTERUS BY BIMANUAL COMPRESSION.

cervix is an unsafe operation, and one the author avoids whenever possible. Ste divulsors (Goodell's, Bossi's, Hegar's) even in expert hands have many times ruptured the uterus, and with fatal results. In the earliest weeks of pregnancy, after the cervix has been softened, one may procure sufficient opening with the dilator to permit curettage. Later, if the cervix is closed and rigid, vaginal anterior hysterotomy is the best method. Nowadays laminaria and other tents are not used because of the dangers of infection.

When the cervix is open to admit one finger, the uterus is to be emptied, preferably under ether anesthesia. If the ovum protrudes through the os, it may be grasped by the fingers or a polypus forceps and withdrawn from the uterus; then the uterine cavity is revised by the finger, and rough places smoothed over with the curet (Fig. 383). If the ovum is still in the uterus, it is completely loosened by the finger aided by the outside hand (Fig. 384). After it is freed from all its attachments

ents, combined pressure by the two hands may squeeze it out into the vagina (Fig. 385). Should this little maneuver not succeed, *the free portion of the ovum is grasped by an ovum forceps (Figs. 386 and 387) and gently withdrawn.* Excessive care is to be observed, first, to make sure that the ovum is really floating free in the cavity of the uterus, and, second, to be absolutely certain that the forceps do not bite into the uterine wall. The latter accident has happened repeatedly and the operator been staggered to find omentum or intestine in the grasp of the instrument. This accident may be avoided by first separating the ovum by the finger, inserting the forceps under the guidance of the finger, and then rotating the blades of the



FIGS. 386 AND 386a.—TWO KINDS OF OVUM FORCEPS.

forceps during the act of closing them, a little trick which the author has attempted to illustrate in Fig. 389; on the least suspicion that more resistance is encountered than is to be expected the instrument must be released. After the main portion of the ovum is removed, the finger is inserted and the endometrium scraped clean and smooth. Since rubber gloves are used, we lose the assistance of the finger-nail. If the cervix is large enough, the finger is covered with gauze, and thus the thick mucus may be rubbed off, but usually in early abortions it is necessary to use the retracter. In using the curet the uterus is to be pulled down by means of a vulsellum

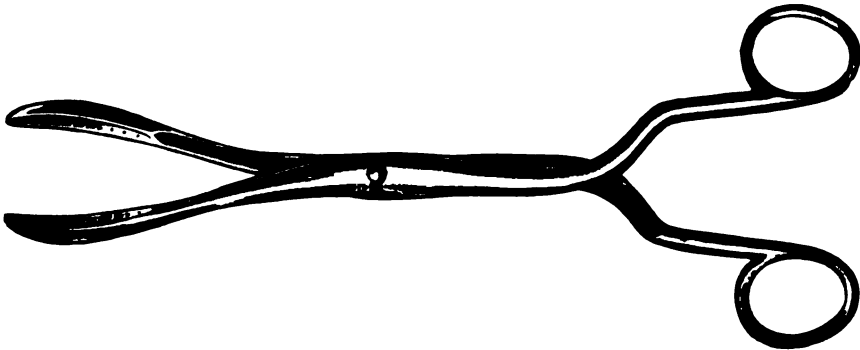
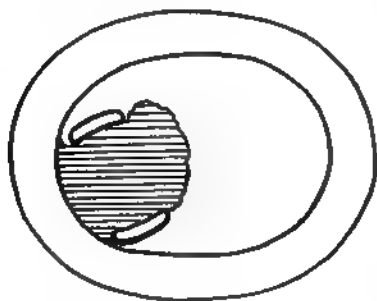


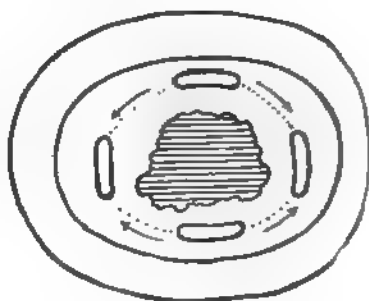
FIG. 387.—OVUM FORCEPS.

forceps (Fig. 392). This straightens the canal and brings the organ within reach. When a thick blunt sound is passed to determine the shape of the uterine canal and the length of the cavity. The curet is passed up to the fundus uteri with the gentleness of the passing of a urethral sound, being held lightly and delicately in the fingers, not in the fist. Exerting slight pressure on the scraping edge of the curet, the instrument is drawn down and out of the cervix with a single slow, even, gentle sweep. The canal is cleansed by moving it to and fro in a solution of lysol, then reinserted, and the process repeated, first going over the posterior wall, then the anterior, then the corners of the uterus, then the fundus from one tubal opening to the other. No up-and-fro movements are made in the uterus; each stroke of the curet must be

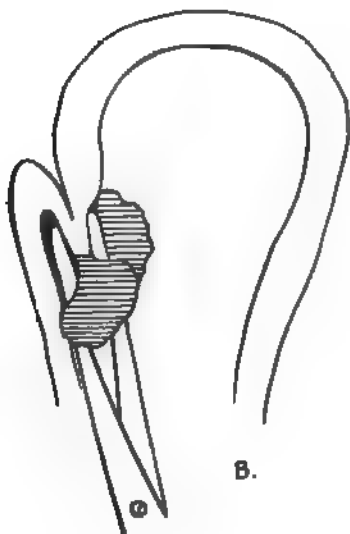
from above downward and out. The broadest curet that will go through the cervix is to be used, but the smaller ones may be needed for cleaning out the tube



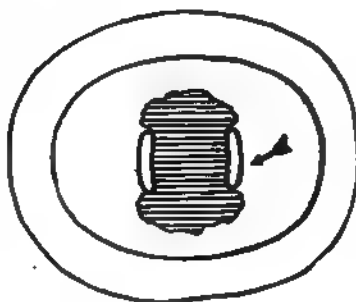
A  
Fig. 388.



C  
Fig. 389.



B.  
Fig. 390.



D.  
Fig. 391.

FIGS. 388, 389, 390, AND 391.—A AND B, FAULTY METHOD OF USING OVUM FORCEPS, BRINGING DANGER OF PERFORATION. C AND D, CORRECT METHOD OF USING OVUM FORCEPS.

corners. By placing two fingers in the vagina one can control the movements of the curet on the anterior and posterior walls (Fig. 393), and by palpating the fundus through the abdomen one can follow it as the upper portions and tubal corners are



392.—VULSALLUM FORCEPS WITH TEETH PROTECTED TO PREVENT INJURY TO RUBBER GLOVES WHILE OPERATING.

ed, thus avoiding the danger of perforation (Fig. 394). Now the finger revisits the uterus, and any piece of tissue found adherent is loosened or removed by the

before the end of the twelfth week the removal of the ovum is easily accomplished, and dilatation of the cervix to admit one finger is usually sufficient. After the fetus is larger and more dilatation is required, for which reason the cranioclast should be used to procure it, or a small colpeurynter is employed. Again the author warns against rapid dilatation with steel divulsors. If, at the time of operation, the cervix is not large enough to deliver the fetus entire, it may be delivered after morcelllement. With the fingers in the uterus a foot is drawn down, and with the scissors the body is split along the spine, grasping successively higher portions of the trunk. Heed is paid to the sharp little bones, and all attention is concentrated on preventing injury to the cervix. With a sharp-pointed scissors the trunk is punctured, and the head squeezed flat with the ovum forceps and delivered. Inadvertently, the trunk is pulled off the head, the operator may have not a little trouble in engaging the round, floating body in the grasp of the ovum forceps.



FIG. 393.—FINGERS FOLLOW EVERY MOVEMENT OF CURETTE.

Fig. 393 shows a good instrument to use in this emergency—an old-fashioned stone ; the blades are opened in the uterus, and the head pressed into them by the internal hand. A better way, in difficult cases, when the cervix is very long, and hard, is to make a transverse incision in the vagina at its junction with the cervix, push the bladder from the anterior wall, and incise the uterus, as in cesarean section. Any one who has attempted to remove a five months' fetus through a long, hard, closed cervix will appreciate its difficulties.

**Complications.**—*Hemorrhage* is usually mild; only rarely is it necessary to pack, and the author uses narrow gauze impregnated with a mild antiseptic (for example, weak iodine), placed over the dressing forceps or the tubular packer shown on p. 933. If, when called to an abortion, a woman is in shock from loss of blood, the uterus and vagina are to be quickly packed, salt administered, and the emptying of the uterus left until the next day, by which time remove the effects of the hemorrhage has occurred.

*Perforation* of the uterus is a not infrequent occurrence and not seldom fatal. It is due to the care of the dangers of curettage and rough handling by the operator, but may also occur even in the most skilful, because the uterine wall is sometimes pathologically soft and friable. This is

puncture, and the conclusion must be drawn that the uterus dilated suddenly, or that the rument passed into the tube. The author has observed two cases where the uterus seemed to be enormously during early pregnancy, a phenomenon also observed by Büttner, of Geneva.

**Incomplete Operation.**—Rarely the accoucheur may be unable to empty the uterus completely, which occurs more commonly after the fourth month. The cervix offers unexpected resistance, or the morcellation of the fetus is impossible and preparations have not been made for sitting operation. Whether the case is clean or not, the mode of procedure here is to pack the uterus firmly with weak iodine gauze. A leg of the fetus may be drawn down and the cervix tightly d around it. Usually pains start up, and after twenty-four hours, on removing the packing, remnants of the ovum come with it. During the operation of morcellation the pieces of fetus, senta, etc., delivered should be spread on a towel and fitted together, thus removing all doubt o how much remains in the uterus.

**Extra-uterine pregnancy** must be thought of before every curetage, and a careful bimanual mination made to eliminate it. Such an operation on the uterus would almost surely se rupture of the sac. Indeed, it is necessary to make a careful bimanual examination as a time practice before operating, to discover the existence of adnexa tumors, for example, pregnancy, pus-tubes, appendicitis, and to determine the position and mobility of the uterus.

**Incomplete Abortion.**—After the diagnosis of material remaining in the uterus has been made, the best treatment is its removal, without trusting entirely to nature's ports. Two courses are advised: one, immediate curetage, dilating the uterus necessary; the other, packing the uterine cavity, tampon of the vagina, and waiting for the contractions of the uterus to expel its contents. The author recommends the latter course for general practice. If the patient is in a good maternity hospital, and on the first examination the cervix is found soft and open for the finger, the uterus may be cleared of its contents at once and the case thus definitively ended. After the tamponade of the uterovaginal tract the treatment is the same as that given under Abortion in Progress.

**Septic Abortion.**—When the cavity of an aborting uterus becomes infected, we speak of septic abortion. Most of such cases are the result of criminal interference by midwives or other abortionists, but sometimes the woman herself passes instruments into the cervix or injects fluids of some kind—usually irritating antiseptics. Thomas tells of a physician's wife who had pushed an umbrella rib up through her diaphragm. The author had a case where the belly was found full of milk, which the unfortunate woman had injected into the uterus. The diagnosis in such instances is very difficult, because the patient generally denies the facts. A thorough physical examination of the whole body will not fail to locate the trouble in the genitalia, and then the demonstration of gestation will clinch the diagnosis. The signs and symptoms of infection will be considered under Puerperal Fever.

Schottmüller, in 100 cases of septic abortion, found the following bacteria:

<i>Streptococcus putridus</i> . . . . .	29 times
<i>Staphylococcus</i> . . . . .	26 "
<i>Bacterium coli</i> . . . . .	19 "
<i>Streptococcus vaginalis</i> . . . . .	8 "
<i>Streptococcus erysipclatis</i> . . . . .	6 "
<i>Bacterium phlegmonis emphysematosæ</i> (Fränkel) . . . . .	5 "
<i>Bacterium coli hemolyticum</i> . . . . .	once
<i>Gonococcus</i> . . . . .	"
<i>Streptococcus viridans</i> . . . . .	"
<i>Bacillus paratyphus B.</i> . . . . .	"

The *Streptococcus putridus* could be frequently demonstrated in the blood, even in those cases where the process was believed, from clinical manifestations, to be purely local, i. e., a puerperia, and it also caused violent salpingitis and fatal peritonitis.

Formerly, the accepted treatment of septic abortion was the immediate emptying of the uterus, by forcible means if necessary, and this practice is still quite general both here and abroad. My experience, however, taught me that this method carried certain risks with it, and I learned also that it was not a dangerous procedure to leave a uterus full of infected ovular remnants to the powers of nature. It has been found that the traumatism of curetage, digital as well as instrumental, may be fatal, a superficial and not dangerous infection being converted into one with strongly invasive qualities. Parametritis, perimetritis, oftener follow such drastic interference than the slower methods. The chill and high fever which so

ers, then revise the uterus with finger; (d) if the cervix is still closed, tamponing; later vaginal anterior hysterotomy.

3. Incomplete abortion: (a) If the cervix is open, empty the uterus at once; if closed, pack the uterine cavity with gauze and the vagina with cotton; (c) day remove the same and treat as No. 2.

4. Septic abortion: Fowler position, roborant diet, etc.; if hemorrhage, tampon; when acute symptoms subside, evacuate; avoid curet.

**Habitual Abortion.**—This is one of the most unsatisfactory conditions the obstetrician has met. Women may have ten to twelve or more abortions without apparent cause and urgently need relief, which is not always forthcoming. The author's routine in such cases is as follows: careful examination of both husband and wife is made to discover, if possible, the cause, following closely the lines indicated on pp. 430 and 433, *q. v.* At least two Wassermann tests of both are demanded in doubtful cases. If the abortions occur in the early months some local cause in the wife will usually be found. If in the later months, syphilis, toxemia, and constitutional causes are sought.

If a reasonable cause is determined, an attempt is made to remove it before the wife conceives again, but this is not always possible and, further, often no certain cause is discoverable. Search is made for focal infection, and if an aborted fetus is obtainable, it, the placenta, and the membranes are examined bacteriologically.

If lues is suspected salvarsan is prescribed for both parents, and in all cases, whether it is detected or not, iron, arsenic, mercury, and iodine are administered as alterative tonics, and are continued throughout gestation. An interval of two years is allowed before another pregnancy, and in the meantime both parents, by outdoor sports, travel, etc., get themselves into good physical health.

During gestation lues, toxemia, diabetes, etc., cervicitis, displacements can be treated more successfully. In the early months corpus luteum extract and minute doses of thyroid are sometimes tried, on experimental grounds.

The patient is kept in bed at the times of the usual menses, at the times she has had the toxemia, and she is enjoined to excessive care in exercise, complete abstinence from coitus. For most of the weeks are spent in bed, and, if needed, an occasional dose of morphine is given.

**Changes in the Ovum After the Death of the Fetus and Missed Abortion.** If the fetus dies early weeks, the chorion and the decidua, which are nourished by maternal blood, may go on growing, but hemorrhages—apoplexies—are very common in the decidua, and one causes the other until the whole periphery of the ovum is invaded. The cavity of the amnion is crowded together, and blood may, in rare cases, break the ovum itself. This is called a "blood mole" (Fig. 396). Or the membranes may undergo an enormous hypertrophy and the amniotic cavity grows larger, fills with fluid, may be the size of that of an ovum of two months. Adhering to the side is found a fetus of three or four months. When the mole is older and, to a certain extent, decolorized, it is called a "fleshy mole." These moles usually cause repeated greater or lesser hemorrhages until finally the uterus expels them or the attempt interferes.

Breus describes a mole in which the amniotic cavity was invaded by a large or larger subchorial hemorrhage, calling it a tuberous subchorial hematoma. Taussig gave it the name of hematoma mole (Fig. 397).

In some unexplained cases the placenta may continue to grow after fetal death, and an enlargement of the amniotic cavity has been found by the author.

Later in pregnancy, after the fetus has obtained some bulk, the placenta becomes similar to those of a dead fetus.

There are cases of "missed abortion," a term first used by Oldham, and are not rare, as many writers state. (1) Maceration is most common, the fetus imbibing the dissolved blood-pigments thus sanguinolent. Its tissues are soft, the joints loose, especially the cranial, the brain is flaccid, the skin flabby, the epidermis missing in large patches, exposing the deep-red corium,

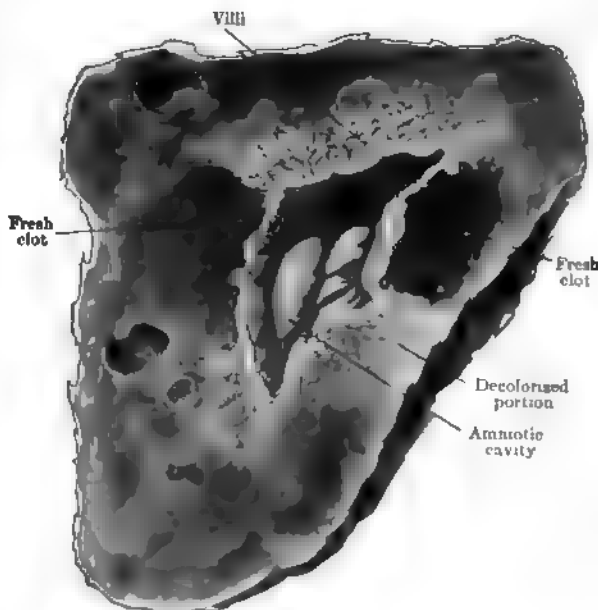


FIG. 396.—BLOOD MOLE.

so, it would be best for every one concerned if every case of criminal abortion were reported to the police authorities. Certainly if the patient dies the coroner must be notified, any other course, as signing a certificate giving a fictitious cause of death, being not alone reprehensible, but very hazardous. An antemortem statement as to whom to blame for the woman's condition is very desirable, even though the physician may not use it. The physician should obtain an accurate history, keep full records of his findings and the course of the disease, and in holding an autopsy on such a case the minutest details of the conditions found in the pelvis must be observed and noted carefully in duplicate, especial search being made for evidence of injury.

The accoucheur is often called to testify as expert in accident cases, the woman suing for damages on the ground that an injury interrupted her pregnancy. The abortion must follow very shortly on the alleged injury, or the death of the ovum must be shown to have very soon followed and the ovum must be otherwise normal, and the woman present none of the recognized causes of abortion, for the medical witness to be able to assert for or against the plaintiff. Indeed, in these actions the witness can usually only say that it is or is not probable that the abortion was caused by the accused injury.

The diagnosis of a previous abortion may need to be made, a subject which was discussed under the Diagnosis of the Puerperium.

**Premature labor** is a labor in miniature, and hardly requires separate discussion. Abnormal presentations are more frequent than at term, the breech presenting thrice as often. Shoulder presentation is also common, but usually nature terminates the case by either spontaneous rectification or evolution. (See Chapter 10) Special regard must be paid to the child, because, owing to its delicacy, it may be injured during birth. Cephalic presentation is the best for premature babies, a fact always to be borne in mind in operative deliveries before term; indeed, the indication for operation must be strict in such cases. Arrangements are to be made beforehand to receive the weak infant into a warm atmosphere—an incubator, if possible. Shock is a vital factor with them.

**Anomalies** in the separation and expulsion of the placenta are perhaps a little more common than at term, and the accoucheur must see that the uterus is thoroughly emptied and in firm contraction. Involution is slower than at term. Ergot is to be given for ten days postpartum.

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## CHAPTER XXXIII

### ABRUPTIO PLACENTÆ

Up to 1664 all hemorrhages occurring during pregnancy were considered as due to premature detachment of the placenta from its supposed invariable site, the fundus uteri. At this time Paul Portal proved that the placenta could be attached to the cervix at the internal os. Rigby, in 1775, differentiated between cases of detachment of the placenta situated above the zone of the dilatation of the uterus and those below that zone. He said that in the latter class of patients, owing to the fact that the placenta must necessarily separate to allow the passage of the child, hemorrhage was "unavoidable," while in the former the hemorrhage is only "accidental" to the separation of the placenta. "Accidental hemorrhage," a term still in use, especially by British authors, means the premature separation of the normally implanted placenta. "Unavoidable hemorrhage" is a term seldom used, but it means placenta prævia, the development of the placenta in the zone of dilatation. The author suggests the term "*abruptio placentæ*" to take the place of the cumbersome, generally used term, and to go with the short and expressive "*placenta prævia*." Abruptio of the placenta means a forcible tearing up of the organ from its normal site, and in reality is an abortion at or near term. Clinically, it is usually easy to differentiate between placenta prævia and *abruptio placentæ*, but the author is convinced that many of the milder cases of accidental hemorrhage are due to the detachment of the placenta situated low in the uterus, but just above the upper boundary of the zone of dilatation. The case partakes then of the characteristics of both conditions.

*Abruptio placentæ*, if one includes the milder cases, occurs oftener than is generally believed. Complete separation of the highly situated placenta is rare, and probably occurs much less often than once in 500 cases. In over 20,000 confinements at the Chicago Lying-in Hospital there were only 14 cases of complete placental detachment with threatening internal hemorrhage, but there were, in addition, 35 cases of partial detachment, the placenta showing a firm antepartum clot, and the clinical course of labor having been distinctly pathologic. Accidental hemorrhage occurs oftenest at the onset of or during labor at term, but it may occur during the last twelve weeks of pregnancy.

*Causation.*—Generally, three causes are distinguishable: (a) Nephritis and pregnancy toxemia with albuminuria; (b) diseases of the placenta and of the decidua and (c) traumatism. In all probability the traumas usually accused act on a diseased organ, and only thus are effective, because the healthy uterus often tolerates all kinds of insults—kicks, blows, etc.—without any reaction.

Winter pointed out the frequency of nephritis in *abruptio placentæ*; Fehling had already shown the coincidence of placental infarcts and hemorrhages in chronic nephritis (the placenta albuminurique of the French). In 58 cases collected by Hofmeier nephritis was shown in 33. Gottschalk suggests that the endometrial changes and the nephritis, or the kidney of pregnancy, may be interrelated, i. e., a toxicosis. Of the diseases, chronic endometritis plays the least important rôle. Degeneration of the decidua, myometritis, syphilis of the placenta, acute infectious diseases with decidual hemorrhages, have also been found. Basedow's disease and arterial sclerosis have been given as causes, and even a severe mental shock, through disturbance of the local circulation. Morse by experiments sought to show that torsion of the uterus and obstruction of its venous circulation cause *abruptio placentæ*.



In the presence of one of the above conditions even a slight trauma may cause a separation of the placenta, and a hemorrhage having been once started, the blood finds its way between the soft layers of decidua and completes the abruption. A turning suddenly in bed, coitus, a blow or kick on the abdomen, the action of a sneeze, severe coughing, have all been assigned. In Holmes' collection of 200 cases in the literature accident was given in 67.

During labor several accidents may cause detachment of the placenta, as sudden emptying of a large polyhydramnion, the loosening of the placenta which sometimes follows the delivery of the first twin, the retraction of the uterus above the child, stopped in its progress by an obstruction in the pelvis, the operation of cesarean section, when the uterine wall is stretched and distorted by the rotation of the child, the delivery of the trunk in breech presentation, late rupture of the membranes, and, finally, traction exerted on the placenta by a cord actually or relatively too short.

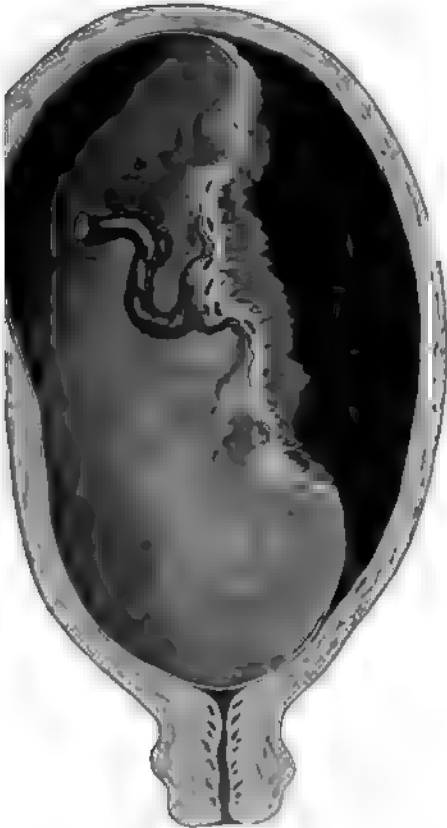


FIG. 398.—ABRUPTIO PLACENTÆ. INTERNAL OR "CONCEALED" HEMORRHAGE.

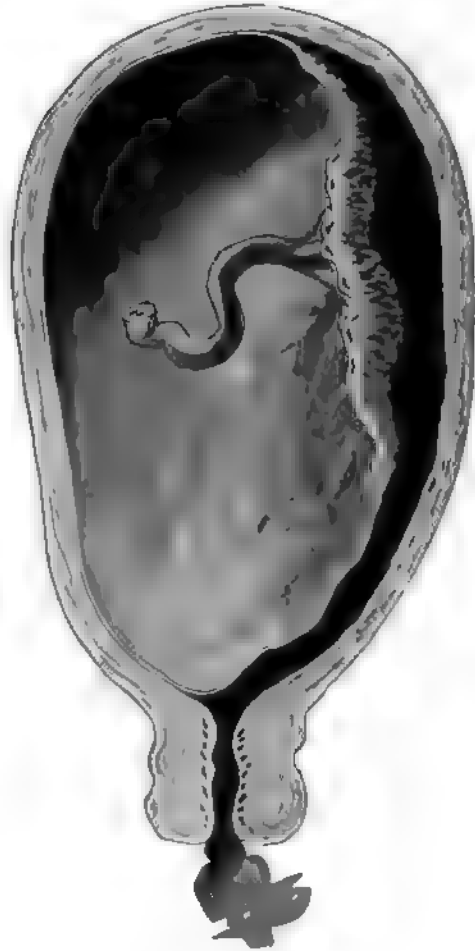


FIG. 399.—ABRUPTIO PLACENTÆ; COMBINED INTERNAL AND EXTERNAL HEMORRHAGE.

**Pathology.**—Separation of the placenta is always accompanied by marked hemorrhage unless the fetus has been dead long enough to allow thrombosis to occur in the uterine sinuses. Since the full uterus cannot retract over its contents, the sinuses remain open and the cavity of the uterus is exposed to the full force of arterial circulation. The blood escaping under the decidua basalis may pursue two directions: First (Fig. 398), and most rarely, it may bulge out the uterine wall toward the abdominal cavity and bulge into the cavity of the ovum, the edges of the placenta remaining attached to the uterus; second, it may dissect up the mem-

branes all the way round, severing almost all the connections of the ovum; third, it may break into the liquor amnii, and finally it may seek a direct passage outward from the edge of the placenta under the membranes through the cervix into the vagina (Fig. 399). The first three varieties are called "concealed hemorrhage," and usually are the most serious, but in all cases the exit of the blood may be blocked by the head or membranes or a firm clot plugging the cervix. The uterus may be immensely distended by the blood, the author in one case removing almost three pints of clots postpartum. Madame Boivin believed that the uterus at term could not dilate sufficiently to allow any considerable hemorrhage, but experience has proved that a fatal intra-uterine hemorrhage may occur without a drop of blood showing externally. A few reports are on record where the placenta, fallen from its

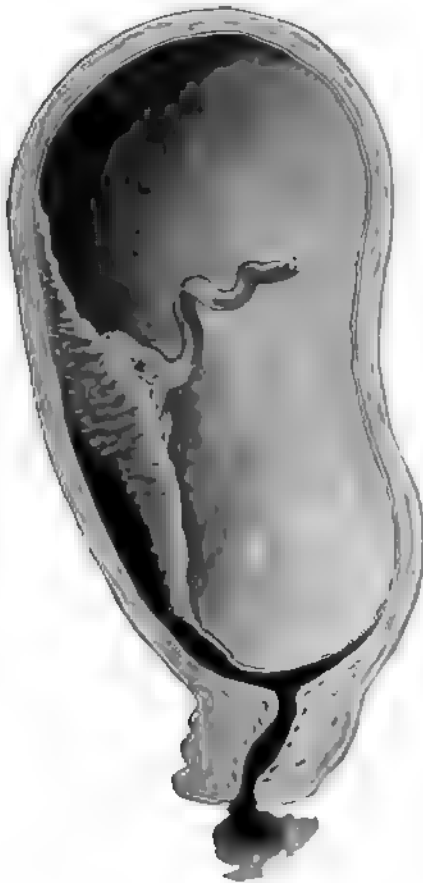


FIG. 400.—ABRUPTIO PLACENTÆ. EXTERNAL HEMORRHAGE

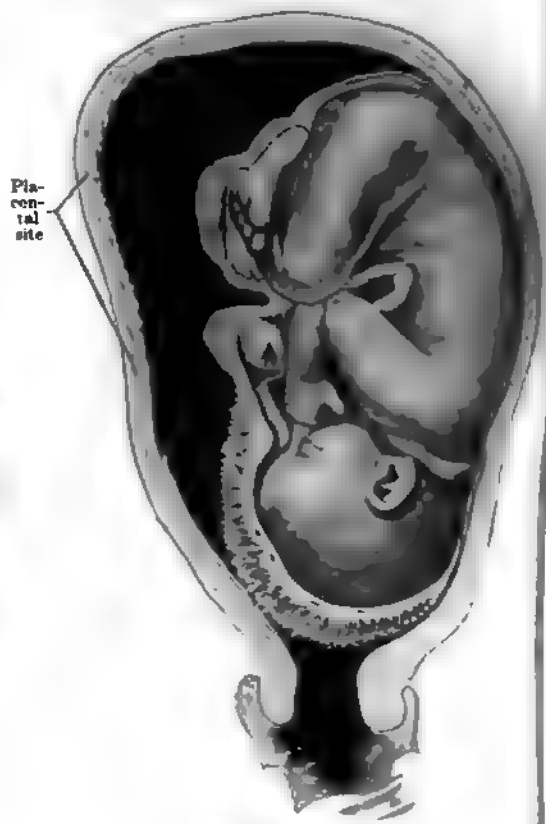


FIG. 401. PROLAPSED PLACENTÆ.

site, has come to lie over the internal os—prolapsus placentæ (Fig. 401). Most of these cases were probably placenta prævia, but a real prolapse of the placenta occurs, and it makes a great deal of difference in the treatment. In 306 cases of abruptio placentæ collected by Holmes and Goodell 193 showed external hemorrhage. In all the author's cases external hemorrhage followed the internal, so that the rule is that the bleeding in abruptio placentæ is first internal or concealed, then combined, external and internal. The mildest case and, fortunately, the most common, is the purely external hemorrhage (Fig. 400). Fraipont found rupture of the serosa over the uterus and one liter of blood in the peritoneal cavity. Without doubt small hemorrhages under the placenta occur frequently during the latter weeks of pregnancy, and organize without producing alarming symptoms, but are

discovered by the watchful accoucheur in the evidences on the delivered placenta; for example, infarcts and hard old, almost completely fibrinous clots, adherent to or incorporated in the membranes or decidua. By reverting to the history of a slight trauma, a sudden pain in the belly, perhaps a slight bloody show, the connection is made clear. The placenta in cases of abruption may show the evidences of several hemorrhages or red infarcts of varying dates; it may be torn or compressed by the clots (Fig. 402), or it may show no signs save a large retroplacental hematoma similar to that which occurs in the third stage of labor. Couvelaire made an important contribution to our knowledge of the pathology of, at least, the serious cases of abruption placenta. He called the condition "apoplexie utero-placentaire," and likened the appearance of the uterus to that of an ovarian cyst with twisted pedicle. The surface is congested, brownish, with sugillations, which sometimes



FIG. 402.—PLACENTA FROM CASE OF ABRUPTIO PLACENTÆ.  
Evidently the first hemorrhage—the blood-clot—occurred several hours before the complete detachment.

extend out on to the ovaries and broad ligaments. The uterine muscle was infiltrated with blood, there were various sized petechiæ under the peritoneum, some of which had ruptured, and the serosa was split in places allowing blood to escape into the free cavity. In the blood-vessels endarteritic and degenerative changes were found.

These findings would indicate a toxic (or infectious?) causation of the primary rhexis of the blood-vessels, and the subsequent abruption of the placenta, and the bloody extravasations between the muscle-fibers would explain the atony of such uteri postpartum.

**Symptoms.**—As was mentioned there are mild cases of abruptio placenta—moderate pain, external hemorrhage, and usually a rapid labor, the delivery of the child, often living, being immediately followed by the placenta and old, firm clots. Again, the accident declares itself in stormy fashion, and medical aid is summoned

**agnosis.**—Acute abdominal pain, referred usually to one side of the uterus, increase of the size and hardness of the uterus, with tension of the abdominal wall, external hemorrhage, absence of the fetal heart-tones, with the general signs of increasing anemia and deepening shock, constitute the foundation for exact diagnosis. In the differential diagnosis placenta prævia, rupture of the placenta, and extra-uterine pregnancy most frequently come up, but on rare occasions may have to eliminate other non-obstetric accidents, as gall-stone colic, rupture of appendiceal abscess or gall-bladder, and intra-abdominal injuries.

## ABRUPTIO PLACENTÆ

## PLACENTA PRÆVIA

*Symptoms*

onset stormy.  
generally referred to the placental site.  
hemorrhage, internally or externally after delivery.  
hemorrhage, usually severe—internal or external.  
usually only one hemorrhage.  
usually find a cause—injury, jar, etc.  
symptoms of a severer hemorrhage than amount of blood externally shows.  
absence of fetal movements.  
hemorrhage continues after the rupture of membranes.  
hemorrhage continuous, sometimes ceasing during uterine contractions.

1. Rather quiet onset.
2. No pain, unless uterine contractions.
3. Hemorrhage always external at start.
4. First hemorrhage generally mild, and always external.
5. Several, or history of several.
6. Usually no cause.
7. Symptoms proportionate to the amount of blood lost externally.
8. No change usually.
9. Hemorrhage usually ceases in all but the central variety.
10. The hemorrhage is increased by the uterine contractions (not constant).

*Signs*

uterus distended, tense, and painful to touch.  
uterus tense, boardlike, cannot feel fetus.  
fetal heart-tones absent.  
usually, no placenta in reach of the fingers.  
bag of waters tense—feel head easily.

1. Abdomen as usual at time of pregnancy.
2. Uterus soft, unless there is a uterine contraction.
3. Almost always present.
4. Placenta palpable in isthmus uteri.
5. Bag of water loose; usually head not engaged.

Rupture of the uterus is often complicated with detachment of the placenta, and, it is possible that an abruption may tear the uterine wall or the peritoneal lining of the uterus. The symptoms of the two conditions, therefore, mingle:

## ABRUPTIO PLACENTÆ

## RUPTURA UTERI

usually during pregnancy.  
uterus enlarged, tense, symmetric.  
uterus contracting.  
usually feel fetus through the os.  
uterus near palpable.

1. Usually during labor, unless from external violence.
2. Uterus small, at one side, with neighboring tumor—the fetus.
3. No uterine pains.
4. No presenting part, uterus contracted and empty.
5. May feel the rent and sometimes the gut.

With a history of violent injury it may be necessary to open the abdomen for diagnosis and treatment.

Diagnostic gestation is indicated by the history, the finding of the empty uterus, the eccentric and asymmetric tumor, and the absence of contractions in labor.

**agnosis.**—Goodell, in his 106 cases, found 54 maternal and 100 fetal deaths, collected only the critical ones, mostly of concealed hemorrhage. Later include the mild and more common abruptions, and the mortality is correspondingly less. Still, the accident is one of the gravest with which the obstetrician has to deal, and it is safe to say that one-half of the women and 95 per cent. of the babies in complete detachments with concealed hemorrhage will die, while a large proportion will be saved with partial detachment and under skilful treatment.

**treatment.**—Divides itself into detachment occurring during labor and that in which dilatation of the cervix is begun.

## CHAPTER XXXIV

### PLACENTA PRÆVIA

PLACENTA prævia is the development of the placenta in part or wholly within the zone of dilatation of the uterus. That the placenta may be found over the os was known since Hippocrates' time, and is mentioned by Mauriceau, Deventer, Pugh, and many others, but they believed that it had prolapsed from its normal fundal insertion. Paul Portal, in 1664, stated positively that the placenta may be implanted over the os, and Giffard, Roederer, Levret, and especially Smellie, emphasized this fact. Rigby, in 1775, however, most clearly distinguished between



FIG. 404.—PLACENTA PRÆVIA CENTRALIS. VELAMENTOUS INSERTION OF CORD.  
Specimen of Northwestern University Medical School.

placenta prævia and abruptio placentaë, although it must be conceded that some of his cases were incorrectly diagnosed. Rigby gave the name unavoidable hemorrhage to the former, and that of accidental hemorrhage to the latter, condition. Hemorrhage in placenta prævia is unavoidable because the placenta must be separated by the advancing child, and this separation causes bleeding, while in abruptio placentaë the hemorrhage is accidental—it is not necessary, even if the placenta is

disunited from the uterine surface, that bleeding should occur. Schaller, in 1709, was the first to demonstrate postmortem the attachment of the placenta over the internal os.

The placenta may attach itself to any portion of the uterus, the fundal insertion being the rarest of all, the posterior wall being the most common site, next the anterior wall, then the sides, and next to the last in frequency the lower uterine



FIG. 405.—PLACENTA PRÆVIA MARGINALIS.

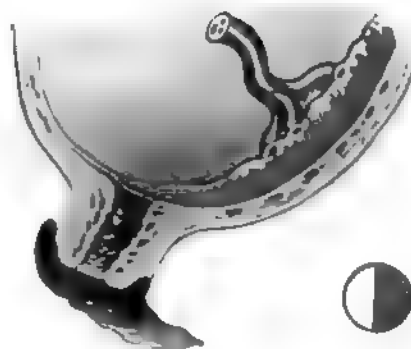


FIG. 406.—PLACENTA PRÆVIA LATERALIS.

segment—the isthmus uteri. The lower edge of the placenta must be at least 10 cm. from the internal os, and well above the upper border of the isthmus uteri, to be normal. When the inferior border lies just at the isthmus uteri, we speak of low insertion of the placenta; when this edge just reaches the internal os, it is called placenta prævia marginalis (Fig. 405); when only part of the opening of the cervix is covered, we speak of placenta prævia lateralis or partialis (Fig. 406), and

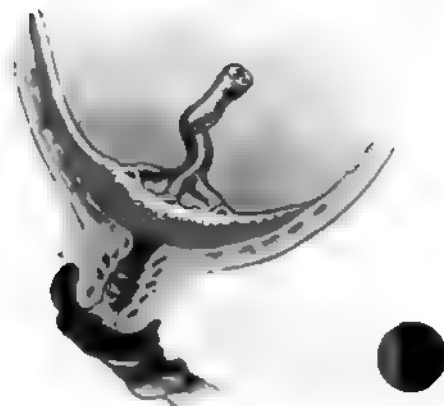


FIG. 407.—PLACENTA PRÆVIA TOTALIS OR CENTRALIS.

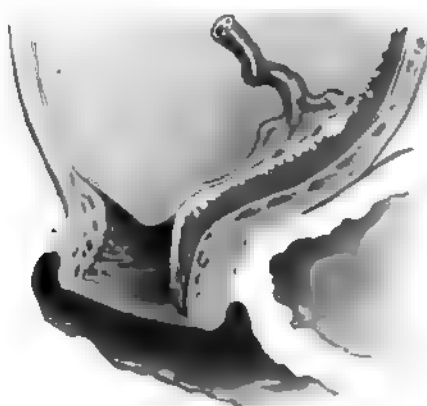


FIG. 408.—PLACENTA PRÆVIA CERVICALIS.

when the os is completely roofed over, placenta prævia centralis or totalis (Fig. 407). Since in the last class of cases the placenta lies almost entirely in the isthmus uteri, this might be called placenta isthmialis. All these terms are relative because of changes in the digital findings produced by the dilatation of the uterus—for example, a marginalis, after the cervix is open, may become a lateralis, and a placenta that seemed to cover all the cervix with two fingers' dilatation subsequently may cover only half of the opening.

cord (Ahlfeld, Wyder, Devraigne). The union of placenta and cervix was very intimate, and required actual digging out of the placenta with the finger-nail. These cases resemble cervical pregnancy, a very rare condition.

Hofmeier believed many placenta prævia are due to the development of the li in the reflexa (Fig. 411). Owing to peculiar nutritional conditions, the chorion does not atrophy, but the villi develop in the reflexa and this surface later becomes applied to the vera on the opposite wall of the uterus.

Placenta that have been placenta prævia exhibit great variety of form, two having already been mentioned. Sometimes there is a tongue of tough, fibrous placental tissue which has overlaid the os; sometimes the edge of the os is encircled by this placental tissue, more or less infarcted. Occasionally—and this in the isthmic variety—the placenta hangs across the lower uterine segment like a festoon. These are the most serious.

**Symptoms.**—Hemorrhage is the first and most constant symptom, occurring in the last three months of pregnancy—most frequently in the eighth. Usually no cause is assignable, the patient waking from sleep to find herself in a lake of blood, or, arising from the toilet, sees fluid and clotting blood in the vessel. *A painless, useless, uterine hemorrhage in the third trimester of pregnancy is almost pathognomonic of placenta prævia.* The first hemorrhage may vary from a few drops, hardly stain on the linen, to a profuse "flood-g," which may be fatal at once, but usually a few ounces are lost as the initial symptom. Each succeeding hemorrhage is greater, and unless treated, a high grade anemia is developed. The accoucheur must not be misled by apparent recovery: this is never complete during pregnancy—the blood is only "patched up"; the system is not in a condition to withstand a new drain, one that is inevitable at labor. Some of the worst cases of spanemia are produced by a condition called *stillæcidium*

*perpetuus*, which is a continuous but very slight dribbling of blood, hardly commanding the notice of the accoucheur, but slowly undermining the woman's constitution. Another important sign is a constant seepage of blood-stained serum. This indicates that a large clot is forming in the lower uterine segment and vagina. Labor usually comes on after the second or third hemorrhage.

In central insertion of the placenta the bleeding usually occurs earlier than in the other varieties, but exceptions are noted, the cervix remaining closed and there being no hemorrhage until full-term labor begins. Such cases have weak pains and are, therefore, unfavorable. In partial placenta prævia the pains of pregnancy are usually present; hemorrhage is, therefore, more constant; the cervix softens and dilates, and treatment during labor is facilitated. Marginal placenta prævia may not cause hemorrhage until the very beginning of labor, or even toward the end of the first stage, and then it is slight. One may suspect the type of placenta prævia from the above symptoms, but exceptions to the rules are very common, the author having met a severe and almost fatal hemorrhage from a marginal insertion and another case of mild bleeding in a complete placenta prævia. Ahlfeld and Edgar



FIG. 411.—HOFMEIER'S IDEA OF REFLEXA PLACENTA.

lost patients from one profuse hemorrhage, and only an edge of the placenta presented. Perhaps the manner of development of the placenta prævia may explain these variations in the amount of hemorrhage.

The origin of the hemorrhage is fourfold: From the sinuses of the placental site; from the intervillous spaces of the placenta; from the circular sinus of the placenta; rarely, and then only as the result of interference, from the villi—that is, the fetal blood-vessels. Owing to the development of the isthmus uteri and the lower uterine segment, and the constant upward retraction of the fibers of the lower portion of the uterus, the area occupied by the placenta is enlarged, but the placental growth is not in proportion. During the painless uterine contractions of pregnancy the lower edge of the placenta, therefore, is likely to be disunited from the wall of the uterus, opening the sinuses and allowing maternal blood to escape. It is easy to see why such hemorrhage is called unavoidable.

Other symptoms of placenta prævia are both inconstant and equivocal, as pain, pressure, and throbbing in the lower abdomen, frequent urination, leukorrhea, and “carrying the child differently.”

Placenta prævia affects the course of pregnancy, labor, and the puerperium. Abortion is not seldom the result of it, though Hofmeier, in sixteen years' experience, could not find one. In several abortions the author found indubitable evidences of low implantation of the ovum. Many cases of placenta prævia give a history of threatened abortion in the early months. Premature rupture of the bag of waters is another sign of low insertion, usually the marginal, and is due to the adherence of the membranes around the os, from catarrhal endometritis or abnormal placentation. Premature labor is, therefore, common. Doran found full-term labor in only 32 per cent. Some authors mention that pregnancy may go beyond term in placenta prævia centralis, but I have had contrary experience.

During labor the low implantation of the bulky placenta causes malpositions and malpresentations, for example, breech and shoulder; delayed engagement of the head; abnormalities of rotation; prolapsus funis; weak pains—all these plus the inevitable hemorrhage and the injuries so commonly inflicted by operative delivery. Air-embolism because the uterine sinuses are so near the external air, and rupture of the uterus because the musculature is weakened by the ingrowth of decidua and the placenta, are commoner than usual.

Postpartum hemorrhage is very frequent, because the lower uterine wall is thin and weak in muscle, which contracts tardily, and closes imperfectly the large venous sinuses, also often being unable to separate the placenta. Further, the placenta is likely to be adherent because of endometritis, infarction, ingrowth of villi (placenta accreta, Fig. 704), or from infection during pregnancy, the placenta being so near the septic vagina. Did not the uterine arteries enter the uterus higher up and, therefore, in the zone of contraction, many women would bleed to death, because the clotting in the vessels is not sufficient to procure hemostasis. No doubt many cases of postpartum hemorrhage are due to low implantation.

In the puerperium placenta prævia also makes trouble: (a) Bits of placenta may remain adherent and become infected; (b) from the close proximity of the placental site to the septic vagina, infection—and that of the most dangerous kind, metrophlebitis—is invited; (c) subinvolution, and (d) finally the woman has the profound anemia to contend with.

These dangers beset the child: prematurity and atelectasis pulmonum; a much infarcted or ill-developed placenta causes the infant to be puny; prolapse of the cord; compression of the insertion of same, and dislocation of the placenta during delivery, may cause asphyxia; injury of the placenta causes fetal hemorrhage; and the infant may suffer from the forceps or version, but especially from the use of its body as a tampon to stop hemorrhage—the Braxton-Hicks method.

**Diagnosis.**—A painless, causeless, uterine hemorrhage in the last three months of pregnancy usually enables a direct diagnosis of placenta prævia to be made, but



the conclusion must be certified by rectal or vaginal examination and the finding of placental tissue over the internal os.

Before making the internal examination everything must be prepared as for operation, and great gentleness is to be practised to avoid separating and tearing the placenta, the dangers being maternal and fetal bleeding. It has happened that the mere insertion of the finger into the cervix has provoked such alarming hemorrhage that treatment had to be instituted there and then.

The peculiar spongy, fibrous feel of the placental tissue may be simulated by a firm coagulum, by thick vernix caseosa in matted hair, by a monstrosity with exposed viscera,—for example, anencephalus,—by hemorrhage into the fetal membranes (which may indicate a placenta located near by), and by thickened membranes. Bogginess in the fornices, the sensation of a flat sponge between the head and the fingers, pulsating arteries, excessive vascularity, and a low and pronounced uterine souffle are all equivocal signs of placenta prævia.

In the differential diagnosis bleeding from varicose veins of the vagina, hemorrhoids, carcinoma cervicis, etc., are easily excluded, but ruptura uteri, ectopic gestation, and abruptio placentæ need more care. (See p. 457 for a table which gives the differential points concerning the last mentioned.) It must be remembered that a placenta situated low in the uterus without being actually a prævia may become partly detached at its lower pole, and the point of bleeding being near the os, the blood escapes readily, not increasing intra-uterine tension and not separating the placenta entirely. In such instances the signs of abruptio may be wanting. Then, too, in the severest cases of abruptio placentæ the organ may prolapse and come to lie over the os.

Rupture of the uterus is easily shut out, but one must remember the tendency of the uterus to rupture when the placenta is low.

Bleeding from a vessel passing over the os from a velamentous insertion of the cord must also be thought of, and also laceration of the circular sinus.

Another point to be determined by the internal examination is whether the previal portion of the placenta is central, lateral, or only marginal—which is not always easy. Sweeping the finger delicately around the internal os, the accoucheur notes where the thin membranes become thicker, then passing into the thick placental margin. If the student will lay a placenta over a ring made by his fingers, he can practise the diagnosis of placenta prævia as on the living.

**Prognosis.**—Placenta prævia is a formidable complication, and annually sacrifices more mothers and children than appear in statistics. These figures, collected from many sources, will give an idea of the mortality of mothers and children.

AUTHOR.	NUMBER OF CASES.	DIED, MOTHERS.	DIED, INFANTS.
Strassman.....	229	22, or 9.60 per cent.	61.22 per cent.
Pohl.....	467	18, or 4.00 "	60.00 "
Doranth.....	216	20, or 9.20 "	60.40 "
Hantel.....	123	12, or 10.00 "	78.00 "
Boss.....	133	8, or 6.70 "	53.00 "
Hannes.....	119	6, or 5.00 "	49.00 "
Hammerschlag.....	191	7, or 6.30 "	84.00 "
Traub.....	120	14, or 11.70 "	55.00 "
Moskow Maternity.....	480	56, or 11.25 "	58.00 "
Author.....	85	3, or 3.55 "	54.11 "
	2153	166, or 7.73 "	61.27 "

This table shows that, of 2153 women with placenta prævia, 166 died, a percentage of 7.68, which is very much better than fifty years ago, by grace of asepsis and better obstetric practice. The Berlin Frauenklinik showed 3.8 per cent. of deaths in 467 cases, and Schauta's Vienna clinic, 5.85 per cent. in 342 cases. Krönig collected 6569 cases which showed mortalities of 9.3 per cent. and 58.7 per cent. respectively for mothers and children. Füh collected 726 cases from private practice near Koblenz, and found 143 deaths, 19.7 per cent., with an infant

mortality of 48 per cent. v. Seuffert collected the statistics in Bavaria from 1878 to 1907 and found 18.99 per cent. for the mothers and 49.32 per cent. of deaths of the babies. Jellett, from the Rotunda, Dublin, 138 cases, 3.69 per cent.; Stratz, of 110 personal cases, 0.06 per cent. mortality. McPherson, in 250 cases in the New York Lying-in Hospital, found 18 per cent. and 57 per cent., but in this are included the moribund cases. McDonald collected reports of 8625 cases, and found 7.22 per cent. and 55.5 per cent. mortalities for mothers and children respectively.

All these figures require careful study before being applied to any purpose, especially for deciding on methods of treatment, because the condition of the patient, whether she was infected before admission to treatment, the degree of the prævia, total or partial, the period of gestation, the amount of blood lost previously, the manner of treatment, etc., must all be properly evaluated—which is impossible. One man's opinion, if he is qualified by general mental ability and clinical experience to render an opinion, is, therefore, usually more useful in deciding on lines of treatment than the largest statistics. The highest mortality occurs in central placenta prævia; the lowest in the marginal variety, which is true for both mother and infant.

Most of the deaths in placenta prævia come from hemorrhage, sepsis, rupture of the uterus, and air embolism, named in the order of frequency. The woman bleeds to death in labor usually because her store of blood has been wasted during pregnancy, or from an injury inflicted by delivery. Sepsis is invited by the proximity of the susceptible placental site to the field of operation, and the fact that hasty and many manipulations are necessary in the treatment. Rupture of the uterus is usually the result of violence exerted by the accoucheur, but may occur from tumultuous uterine action. Air-embolism is rare, but does occur, experiments on animals to the contrary notwithstanding. The children die from asphyxia through dislocation or compression of the placenta, tearing of the placenta and fetal hemorrhage, from being used as a plug in the Braxton-Hicks treatment, further, from prematurity. Later methods of treatment have improved the child's chances.

The prognosis as to health is also bad. Puerperal infection is of very frequent occurrence, resulting in life-long invalidism; the anemia may cause permanent changes in the blood-forming organs and in the nervous system, and the woman may be damaged by the operations performed for delivery.

**Treatment.**—Fortunately, we possess rational and certain methods of treatment for this formidable accident, which cannot be said of most other obstetric complications. In deciding on the course of procedure in the individual case many factors must be considered: the surroundings of the patient; the condition of the mother and that of the child; the necessity for preserving the infant (Catholic family); the skill of the accoucheur; the degree of the prævia—whether partial or total; whether the patient is in labor or not; and the amount of dilatation of the cervix. From his own experience, and from thoughtful consideration of the published experience of others, the author would lay down these axioms:

1. A woman with placenta prævia should not die, except in the very rare instances of air-embolism, hemorrhagic diathesis, or spontaneous rupture of the uterus.

2. Every woman with placenta prævia should be sent to a well-equipped maternity hospital unless she is able and willing to provide the several physicians and nurses necessary in her own home. It is otherwise impossible to give the patient all the benefits of our art.

3. With two exceptions every pregnancy complicated with placenta prævia should be terminated as soon as the diagnosis is made. When the bleeding is indeed slight, and when the child is very near the border of viability, one may temporize a few weeks, *providing the patient will remain in bed in a good maternity hospital*. Should the woman refuse to go to the hospital, and also to allow the accoucheur to induce labor at her home, the attendant had better drop the case and let the patient employ a physician in whom the gambling instinct is better developed

ooding" may occur during the night, and the woman lose a fatal amount of blood before aid can reach her. Dr. W. W. Jaggard said, "there is no expectant treatment for placenta prævia."

1. One must distinguish sharply between maternity and private practice, measures which are safe in the former being impossible in the latter. In the maternity hospital one should make a consistent effort to save the life of the child, but at home one must use that method which will put an immediate stop to the hemorrhage, with, if necessary, less regard to the child. Also the accoucheur will use the procedure which he is best able to carry out, and must know all methods of delivery, as well as be able to suture the cervix and perform vaginal and abdominal hysterectomy, etc.

2. When labor has begun in a case of placenta prævia, the accoucheur must remain by the patient until she is delivered and out of danger.

3. At all times in the treatment of these cases the accoucheur should heed this thing, *save blood!* One can never foretell how much of the vital fluid the woman will lose in the successive stages of treatment, nor does one know what is the parturient woman's ability to withstand bleeding. A loss of a pint will kill one woman, another will recover from the loss of three quarts. Be not extravagant with blood-letting during the first and second stages of labor, because the normal flow in the third stage may be a fatal drain. Therefore if, on arrival at the bedside, the accoucheur finds the woman already anemic, it is unwise to use uncertain methods, regardless of all else, the hemorrhage must be arrested at once and every possible drop of blood spared.

*During pregnancy*, before labor-pains have begun, if one has decided to assume the risk and to temporize, the woman should be put to bed at the first indication of hemorrhage, and she should be in a perfectly appointed maternity hospital. If hemorrhage is free, a firm vaginal tampon is to be applied. In all cases of hemorrhage during pregnancy a firm tampon is indicated, in order to limit the loss of blood to a minimum. If the woman is to be transported to a hospital, a provisory tampon is to be applied, as the unavoidable jolting on the way will increase the bleeding. The application of a tampon to control hemorrhage is by no means a simple matter. Unless the head is engaged in the pelvis, it is impossible to apply the tampon so firmly that all bleeding will be stopped, and since the head has sunk so low, one must be content with checking the flow. Dry sterile gauze is best for the purpose, and the rules of asepsis must be especially strict. Counterpressure is to be applied with a firm abdominal binder, as in Fig. 403. When an aseptic tampon aseptically applied becomes a source of danger very soon, for this reason it should be removed in twelve hours and not renewed unless absolutely necessary. On the appearance of another hemorrhage action is decided—there is no wisdom in waiting longer. It is a wanton exposure of the mother to immediate and future danger for the sake of an infant which will probably succumb during delivery or shortly after.

If the patient is near the ninth month, the child is viable and well developed, on its account there is no reason for waiting.

*During labor* we have four objects to accomplish: First and most urgent, to stop the hemorrhage; second, to empty the uterus; third, to insure hemostasis; fourth, to combat the anemia.

We must stop the hemorrhage, then, first of all, and it matters a great deal whether the patient has already lost much or little blood when it comes to the selection of the method of stanching the flow.

In cases of marginal placenta prævia the hemorrhage usually begins toward the end of the second stage of labor and is very slight. The proper treatment is to use the bag of waters. This method is named after Puzos, who mentioned it first, but Justine Sigmundine had done it one hundred years before and Puzos knew nothing of the nature of placenta prævia, and, further, Mauriceau ruptured

the process of separation, and the head may now enter the lower uterine segment and apply itself against the placenta, thus aiding in stopping the hemorrhage. But rarely a case will occur in which, even in a marginal prævia, puncture of the bag of waters will fail to arrest the flow. Such cases are treated like central and lateral implantation.

The usual condition met is a more or less severe hemorrhage, with the os admitting two or more fingers. Pain may or may not be present, but some uterine action must have taken place or the hemorrhage and dilatation could not have occurred.

There are now three methods of treatment—Braxton-Hicks' version, metreurysis, and cesarean section. Which one should be selected depends on several conditions. If the woman has lost much blood; if the babe is dead or dying, or if it is very premature, so that its chances are very slim; if one has had little experience with placenta prævia—Braxton-Hicks' version is preferable. Bring down one foot, make

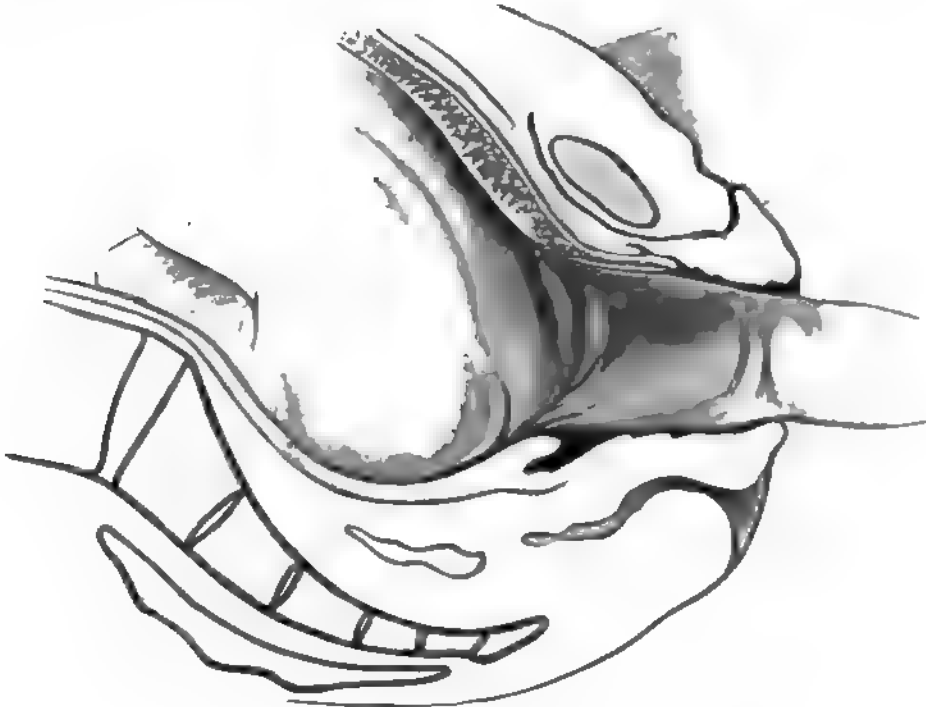


FIG. 414.—BRAXTON HICKS' VERSION COMPLETED.

Breech acts as tampon and squeezes placenta against bleeding vessels. It is essential for success to be certain that the placenta lies flat against the uterine wall, and is not bent back on itself, exposing uterine vessels.

slight traction on it, so that the infant's thigh compresses the placenta against the cervix, thus stopping the hemorrhage. *Then leave the case to nature.* Do not extract the child; do not put traction on the leg unless bleeding recurs. If oozing commences, pull lightly on the leg. The object of this method is to use the child's body as a cervical tampon to stop hemorrhage, and to stimulate pains *until the cervix is ready for safe delivery.* Neglect of the above advice and rapid extraction have cost many mothers their lives, and the object sought, the saving of the child, has usually been frustrated by the attempt itself.

In performing Braxton-Hicks' version these points are to be noted. Puncture the membranes at the side of the cervix as far from the edge of the placenta as possible (Fig. 412). Then, disregarding the bleeding, which now commences and is sometimes furious, pass the hand into the vagina, the two fingers through the rent in the membranes alongside the head. The head is gently pushed to one side, while the outside hand presses first the breech, then the foot, down in the direction of the inside fingers. The fingers seek the foot, and as soon as this is grasped, it is led down

generalized, though even now few accoucheurs are aware of its immense advantages. It is applicable at all stages of cervical dilatation, before the os is sufficiently open to permit delivery. It may be used to induce labor, or it may be used when version has been tried and has failed. One may dilate the cervix sufficiently to proceed with immediate delivery, or one may dilate sufficiently for the performance of version, after which the case may be treated according to conditions as they arise. The colpeurynter (or metreurynter) marks nearly as great an advance in the treatment of placenta prævia as did the introduction of Braxton-Hicks' version. Metreuryntesis is used in cases where the condition of the mother and child is good. When the mother has lost little blood and the child is viable, we may take a reasonable chance on a little greater hemorrhage for the sake of the infant.



FIG. 416.—FILLING COLPEURYNTER. (Some operators prefer a piston syringe.)

Several bags are on the market. The original, Carl Braun colpeurynter, is as good as any of the later modifications, and I use it considerably (Fig. 795, p. 937). Voorhees, of New York, made a modification of the Champetier de Ribes' inelastic conic balloon, which is very serviceable, and sizes may be gotten large enough to secure complete dilatation. I use it in cases in which the head is low in the pelvis, as its flat top does not displace the head much. The size of the bag should be but little less than the estimated size of the fetal head.

All preparations are made beforehand. The bag and the bulb syringe for filling are sterilized by boiling twenty minutes in plain water. The colpeurynter is emptied of air first. This is accomplished by filling it with 0.5 per cent. lysol solution, then inverting it so that all this fluid runs out. A clamp is now affixed four inches from the end of the tube. The air is all pumped out of the bulb syringe and the nozzle fitted into the end of the tube of the colpeurynter. For greater security this tube may be tied on with tape. The bag is now folded lengthwise into as narrow a compass as possible, and then grasped by the long uterine packing forceps. The whole apparatus lies in a basin of 0.5 per cent. lysol solution, from which it is to be filled.

The membranes are now punctured as for the performance of version, and, operating quickly,

guided by the two fingers in the cervix, the bag (Fig. 415) is placed inside the uterus *on top of the placenta*. Be careful not to push up the edge of the placenta so that it doubles up under the colpeurynter. This would allow intra-uterine hemorrhage. The clamp is now removed from the tube, and steadying the colpeurynter on the placenta, the other hand, by slow pressures on the bulb of the syringe, injects the required amount of lysal solution (Fig. 416). Fourteen to 20 ounces are required, varying in individual cases. Each full compression of the bulb of the syringe is about one ounce, and in this way the amount may be estimated. If the child is small, the bag need not be fully distended; if the patient is at term, 18 to 20 ounces are needed. If too much solution is injected, the bag will not apply itself to the placenta, and hemorrhage will continue, upon seeing which one will allow a few ounces to escape through the tube. If too little is injected, the colpeurynter will fall out before the os is sufficiently dilated. One must inject slowly in order not to overdistend, and too rapidly stretch, the lower uterine segment. The head, of course, is displaced by the colpeurynter, but this cannot be avoided. Since, when the bag is expelled, delivery is consummated, little harm results from displacing the head. After the bag is in position one reassures himself that the placenta is underneath it, and not doubled upon itself, and withdraws the hand from the vagina. Now the tube is clamped with an artery forceps and slight traction exerted on it (Fig. 417). Only sufficient pressure is brought to bear on the placenta and cervix as will stop the hemorrhage. This accomplished, the accoucheur seats himself at the bedside and maintains slight traction on the tube of the colpeurynter. One or at most two pounds will be required, and to determine the

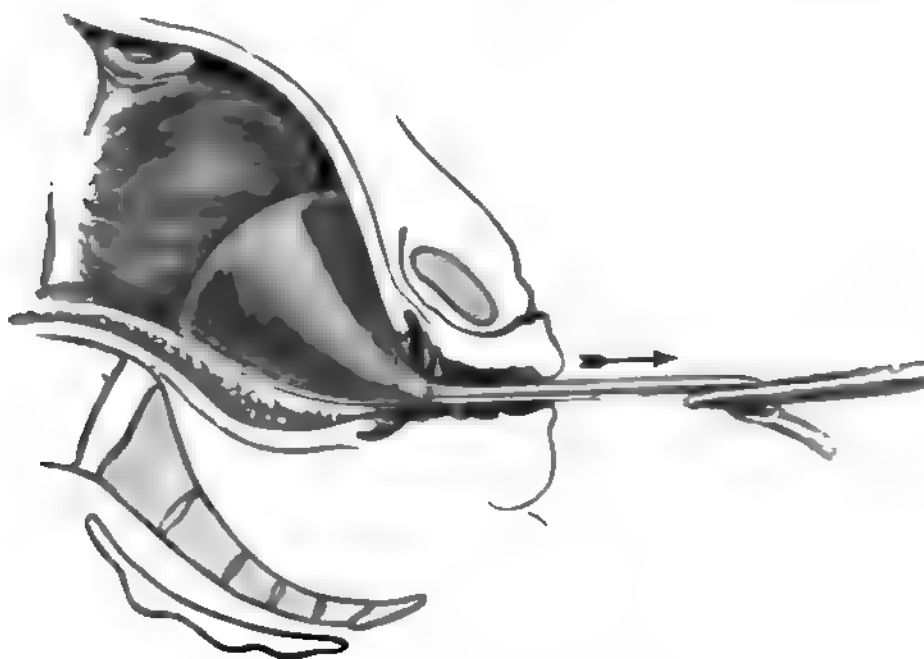


Fig. 418). It is a very serious loss, because one cannot control the hemorrhage so well as dilatation of the cervix as before, unless it is possible to deliver at once. Sometimes the head comes down and takes the place of the colpeurynter, tamponing the cervix securely. These are fortunate cases, and one has nothing to do but watch and let nature take the lead. It is advisable, soon as the head has passed the cervix, to deliver, because the child's life is in a rather precarious position, and second, the placenta may separate and blood may accumulate in the uterine cavity.

The accoucheur determines that the colpeurynter is passing the cervix, first, by noting the steady advancement of the tube, by occasional direct rectal examination one feels the cervix spring over the greatest circumference of the bag; third, the patient begins to bear down, and the pain has a sharp cutting character; fourth, after the bag has passed through, the pains cease entirely; fifth, the bag is expelled—but the two latter signs show delinquency on the part of the accoucheur. By the time the bag comes to pass through the cervix, the attendant must be ready to deliver or to do a version, as indicated. The time consumed in getting ready, after the bag has slipped through the os, may mean a fatal loss of blood.

If the head does not follow the metrcurynter into the pelvis, the operator withdraws the bag quickly from the vagina, emptying it, if necessary, as quickly inserts his whole hand, and grasps the cervix and placenta until he can determine on the course of procedure. If the head is still

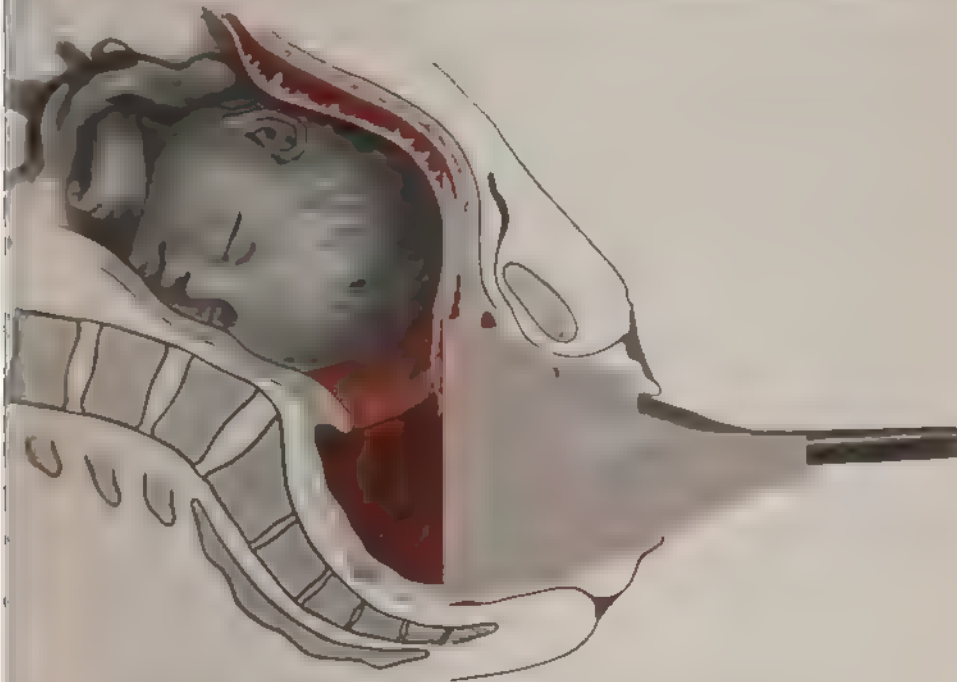


FIG. 418. BAG HAS PASSED THE CERVIX AND BLOOD HAS ACCUMULATED BEHIND IT

high, he tries to force it down into the pelvis. This will stop the hemorrhage and allow the forceps to be applied. If the head does not go into the pelvis, podalic version is to be performed. If the cervix is not sufficiently dilated by the first attempt with the colpeurynter, one may insert a larger one and fill it with a larger amount of water,—20 to 24 ounces,—which will dilate the os to the size of the fetal head.

The heart-tones of the child must be carefully noted after the version is done and during the time the colpeurynter is in place. If the cord is in the area of the placenta compressed by the breech or colpeurynter, some asphyxia of the infant is unavoidable. This may not be fatal, but is very unwelcome, the more so because we are practically powerless to extract the child until the cervix is dilated. The most we can do is to try, if safe, to hasten the dilatation of the cervix somewhat. This is done by exerting a little more traction on the breech or bag, say 2½ pounds—fifth, of course, the precautions already emphasized. If an urgent indication on the part of the child for delivery should arise before the cervix is sufficiently dilated, it will have to be disregarded. The danger of haste is too great for the mother. An indication for delivery will not arise on the part of the mother, because we can

control the hemorrhage by the colpeurynter or the breech. Great hemorrhage and collapse do not indicate rapid delivery; on the contrary, the sudden emptying of the uterus may add to the shock and turn the delicate balance against the woman. In such cases of severe hemorrhage and shock the quickest and most definitive means of stopping the hemorrhage is by version and tamponing the lower uterine segment by the breech. One then has the case absolutely under control, and now the patient may be stimulated and her blood-loss replaced with saline solution.

Since there is no hemorrhage, there is not the shadow of a reason for hurry. These hours may be employed in supplying the woman with fluids, as saline solution hypodermically, transfusion, food, etc. The woman recovers from the shock of her first hemorrhage. The hours are also useful for the preparations for delivery. No detail should be omitted, and everything must be gotten ready and rehearsed beforehand, so that when the delivery is to be made, not an instant's delay need be tolerated. A complete set of obstetric instruments should be sterilized, especial provision being made for the treatment of postpartum hemorrhage. Needles, long needle-holder, vulsella, specula, etc., for sewing lacerations of the cervix may be needed, as well as gauze and long uterine packing forceps for tamponing the uterus, also a Momburg tube. Good light and a table on which to place the patient for delivery should be gotten ready, and provision made for the resuscitation of the child—tracheal catheter, hot bath, hot towels, etc., should be at hand.

The nurse prepares the douche-bag for giving a hot (120° F.) injection of sterile water, and sees that there is a supply of sterile solutions, sponges, towels, etc. As a rule, the cervix may be sufficiently prepared to permit delivery, but let me again sound the warning—*Beware of too hasty extraction through a poorly dilated cervix!* The laceration of the highly vascularized cervix is one of the most formidable accidents the accoucheur could meet. The uteroplacental sinuses are so superficial that a tear  $\frac{1}{8}$  inch deep may lay one open. The contraction and retraction of the lower uterine segment are poor at best, and poorest in placenta prævia, and this means of hemostasis is not strong, so that the cases of fatal hemorrhage from even tiny tears of the placental site are easily explained. Avoid pituitrin. Slowest possible delivery is to be practised. If the head is restrained by a tight cervix, the accoucheur must not use force to extract it, but must courageously allow the infant to die. The child is so often already lost that this painful advice is seldom needed. An attempt to let air into the child's lungs must be made by pulling the vagina back with a speculum, and, after cleansing the fauces, depressing the jaw with the fingers, an expedient which was recommended by Pugh, in 1754, though not in such cases.

Should placenta prævia occur in a primipara or in others, and the cervix be closed so that one finger may not be introduced, the case becomes more formidable still. For such patients the vaginal tampon and the colpeurynter have been recommended. There are real objections to both on the score of sepsis and inefficiency. Unless the head is firmly engaged in the pelvis, the tampon will not exert sufficient compression on the cervix and placenta against the head to check bleeding in this manner. Then the external is converted into an internal hemorrhage. The same is true of the colpeurynter. I have never failed to pass the colpeurynter into the uterus, and I never use the tampon except provisionally, during the transportation of the patient, or while other preparations are being completed. It is for these cases that cesarean section has been recommended—*vide infra*.

*Treatment During the Third Stage.*—Many patients have been lost at this point, having been skilfully carried through the two other stages. It is necessary to save blood with every move. As soon as the child is delivered, as in cesarean section, it is handed to a competent assistant, the operator devoting all his attention to the mother. Even a moderate hemorrhage now demands the immediate removal of the placenta. Since contraction and retraction of the bed of the placenta are imperfect, and especially since its structure may be pathologically altered, the delivery of the



placenta is slow and adhesions may be met with, some of which are so tough that the finger cannot break them. As soon as the placenta is removed the uterus usually contracts strongly and bleeding ceases. Watch closely, *pulling open the vagina with a speculum to see if blood continues to escape from the cervix*, and if it does, tampon the whole uterovaginal tract firmly. *Waste no precious seconds on uncertain methods of hemostasis*, but in the presence of such urgent symptoms use the most radical and definitive means we have. During the ten to twenty seconds while waiting for the gauze hold the uterus securely in forced ante flexion (Fig. 718), or apply Momburg's belt. (See Treatment of Postpartum Hemorrhage, p. 796.)

In placenta prævia a tiny laceration may give rise to a fatal bleeding. The soft, vascularized cervix is difficult to hold for suturing, and it may be impossible to sew up a laceration or to sew it up quickly enough to save an already exsanguinated woman. In suturing a laceration of the cervix it is necessary to expose the field thoroughly by broad retractors (Fig. 689). The lips are grasped with the vulsellum forceps, and the tear brought within reach of the needle. Usually the field is so flooded with blood that it is impossible to see where to sew. A bullet forceps may be laid temporarily on each side of the uterus, seeking to secure the uterine arteries in the bases of the broad ligaments (Henkel, or Momburg's belt applied). In one such case I packed the uterus and the rent in the broad ligament firmly with gauze, thus stopping the furious flow, after which the lips of the cervix were united over the tampon, thus closing up the uterus entirely (Fig. 725). The vagina was snugly packed with dry cotton to exert counterpressure. The sutures were removed the next day and the gauze two days later. The patient recovered.

Before, during, and after delivery in cases of placenta prævia it is often necessary to treat the anemia. If the mother has lost much blood, give her saline solution under the skin, not per rectum, as this interferes with the asepsis of the local treatment. When the bowels are moving over the field of operation, it may be impossible to avoid carrying the discharges into the uterus. Saline solution is to be given even if the hemorrhage is going on, as then the patient does not lose pure blood, but blood mixed with salt solution. We do not wait for fainting to stop the hemorrhage in placenta prævia. The author has administered a gallon of saline solution under the skin and it was absorbed as fast as it could be injected, and, after the local treatment of the case was completed, two quarts more per rectum, with success. Such large amounts are seldom required. Remember transfusion.

*Other Methods of Treatment.*—Accouchement forcé, the rapid dilatation of the cervix, tearing and cutting it, if necessary, followed by the immediate delivery of the child, has no place in the treatment of placenta prævia. The author believes it is almost criminal, and it is opposed to all recognized principles of treatment. The results condemn it, and Kerr says, judging from mortalities, it is the worst of all methods. Treub retracts his recommendation of it, saying that his mortality was 18.25 per cent. for the mothers and 48 per cent. for the children. Müller showed 44 per cent. maternal mortality and 62.7 per cent. for the children. Gentle dilatation is wanted, for even the soft-rubber bag may rupture the cervix unless properly handled. The same may be said of Bossi's branched powerful steel dilator and of the others of the class.

Separation of the placenta, or its removal before delivery of the child (Simpson, 1840), is obsolete. Miller, of Pittsburgh, ligated the uterine arteries in 11 cases, saving the first and last eight of them.

Cesarean section, first performed by Tait, is gradually gaining reluctant recognition. Especially favored by American surgeons and gynecologists, it was condemned by American and European obstetricians,—Ehrenfest, Hirst, Holmes, Schauta, Hofmeier, Ahlfeld,—but very recently the operation has begun to enjoy more, and I think just, popularity. Williams and Edgar give it qualified approval,

Sellheim, Krönig, Pankov, P. Dudley, Fry, Donoghue, Zinke, Kerr, Laphom Smith, Bar, Recasens (Madrid) recommend it—of course, in well-chosen cases. At the meeting of the American Gynecologic Society, April, 1909, the subject was thoroughly handled, and at the meeting of the American Medical Association in June, 1914, E. P. Davis read a strong paper on it, and while the opinions were divided, a perusal of the transactions is convincing that cesarean section, in the hands of the expert abdominal operator, is a valuable addition to our treatment. Cesarean section has a general mortality of 4 per cent. in favorable cases; it should be no more than this in favorable cases of placenta prævia, and there is, in addition, the reduction of the infant mortality from 50 to 5 per cent. Placenta prævia, under the usual methods, shows at best 4 per cent. mortality, and its treatment entails great anxiety, much loss of time, and requires exceptional obstetric skill to save both mother and child. In the isthmial variety, where the placenta is implanted squarely over the internal os and hangs like a festoon above it, the maternal mortality is so high that the abdominal delivery is strongly the method of choice. Without going further into the discussion, I will state my position: an indication for cesarean section will arise in cases of central and of partial placenta prævia, when the pregnancy is at or near term, with a living child, the mother in good condition, the cervix being closed or promising difficulty in dilatation, conditions most common in primiparæ. A necessary requirement also is that the aseptic facilities of a good maternity can be had, or improvised at home, and a man capable of his task is obtainable.

The best time to do cesarean section is before the pains have stretched the cervix and the bed of the placenta—the isthmus—open, because then postpartum hemorrhage is difficult to control. Uterine packing must be held in readiness and a bleeding not permitted to grow in force. To stop the flow while the uterus is gathering itself together, inject pituitrin right into the uterine muscle (avoiding the veins), compress the aorta as in Figure 717, or pack the uterus from above, leaving one end hanging down in the vagina. If the woman has a number of children, and the bleeding approaches the danger limit, or if the intention was to sterilize her, do a Porro operation.

In the exigencies of general practice, and in the usual bad surroundings in which these cases come to the accoucheur, it is found that the best method of treatment is Braxton-Hicks' version and very slow spontaneous delivery. Next comes the metreurynter.

Vaginal cesarean section was performed by Dührssen and is recommended by Bunn for placenta prævia. It is condemned by most writers, among whom are Kerr, Spencer, Peterson, Newell, Hofmeier, Hannes. I have done it once with success, when the placenta was low in the uterus and had partly separated, but believe that the operation is not to be recommended in the treatment of placenta prævia.

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## CHAPTER XXXV

### MULTIPLE PREGNANCY

PLACING this subject in the pathology of pregnancy might elicit comment, but the succeeding pages, showing the frequency of maternal disease and of fetal death, will prove that, in the human female, having more than one offspring at a time is distinctly abnormal. It is an atavistic reversion, and, in general, such reversions are abnormal. Twins occur, according to Guzzoni, who studied over 50,000,000 births, once in 87 cases, triplets once in 7103; quadruplets once in 757,000; quintuplets once in 41,600,000 births. Over 30 cases of quintuplets have been reported. Vassali reports an authentic case of sextuplets, at Lake Lugano, there being delivered at the fourth month two female and four male children with a total weight of 1730 gm.

The frequency of multiple pregnancy varies with the fertility of the people (Peuch, 1873), and the fertility varies in different countries and at different periods; thus in Ireland and Russia twin births are commoner than in France, where the birth-rate is low.

Multiparæ, especially those giving birth frequently, are more likely to have twins, and the probability increases after the age of thirty-three years in both parents. A hereditary disposition is certain, and the tendency, while usually transmitted by the mother, may also be given through the father. It is also noted in the lower uniparous animals, for example, the cow (Duncan). Marriage of twins increases the potency of the hereditary impulse. Twins and triplets are likely to be repeated in the same

family. Cases of unusual fertility are not rare. Geisler tells of a woman physician (Mary Austin) who, in thirty-three years' wedlock, had 13 twin and 6 triplet births, a total of 44 children, her sisters having 41 and 26 children respectively (Strassman). Sue tells of a Parisian whose wife bore him 21 children in seven years, and who seduced a servant who then delivered triplets. (See Neugebauer.)

**Causation.**—Generally, two kinds of twins are distinguished, those coming from separate and distinct ova and those from one ovum. Two eggs escaping from an ovary at the same time may be fertilized and develop synchronously in the uterus. These eggs may even come out of the same Graafian follicle, since such follicles,



FIG. 419.—DOUBLE OVUM TWINS.

Black lines are decidua; red, the chorion, blue, the amnion.

and even some containing three eggs, have frequently been seen. Each ovary may furnish one of the ova. When two or more separate ova locate in the uterus, we have distinct ovular formations developing side by side (Fig. 419). If the ova locate far from each other, two distinct placentas develop; if near each other, the two placentas fuse, but their circulations do not (Schatz). Since in such cases each child has its own amnion and chorion, where the membranes lie apposed a septum will be found made up of four layers—an amnion and a chorion for each fetus. Occasionally decidual remnants will be found in the septum, the relics of the decidua capsularis or reflexa of the early stages of the development of the ova. Theoretically, one might insist on finding six layers in the septum of double ovum twins—two decidua, two chorions, and two amnions.

The etiology of twins from one ovum, called homologous, or monochorionic, is still a mystery. Aristotle knew that two embryos could come from an egg with

two yolks, and three embryos have been found in one egg. Two nuclei have been found in one yolk, and Kölliker, Stöckel, and von Franque found double germinal vesicles in the human egg. If such an ovum is to be fertilized, two polar bodies must first be extruded, and two spermatozooids are needed for fertilization, which theoretically is not impossible, but then we would have two chorions developed and the findings would be the same as if two different eggs had been impregnated. Perhaps we shall learn hereafter that such an occurrence has been proved. Another theory is that on one germinal vesicle two primitive streaks develop, that is, double gastrulation occurs. Two spermatozooids entering the ovum probably cannot produce this condition, because ova fertilized in this way usually die.

If the two embryonal spots develop close to each other, it is possible that one amnion will

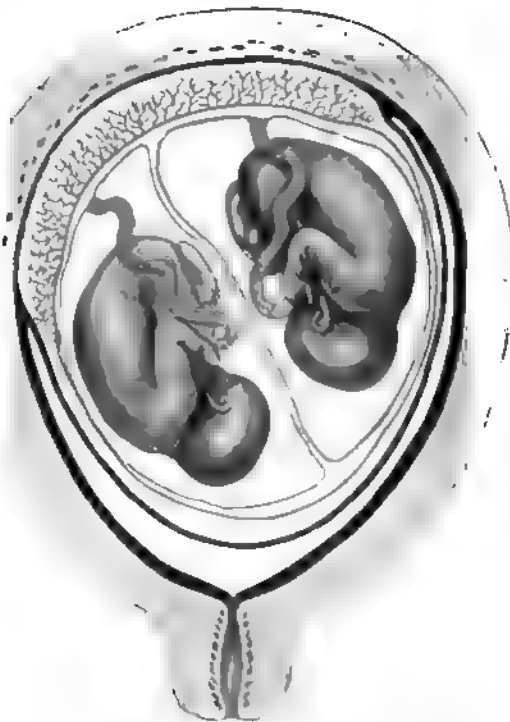


FIG. 420. HOMOGENEOUS TWINS. (After Schatz.)

inclose the two fetuses; if far from each other, each fetus will have a separate amnion (Fig. 420). The older writers held that always two amnions developed, but that the septum atrophied and disappeared. Only about 40 cases are on record of twins without a septum between the two sacs, that is, lying in one amniotic cavity. Should the separation of the two embryonal areas be incomplete, a double monster will result. Soberly, therefore, according to the theory that homologous twins are the result of the fission of the embryonal area into two parts, and their separate development into fully formed fetuses, we must conclude that double monsters, like the Siamese twins, are the result of incomplete fission and not of fusion. A monster with four legs will mean a fission at the lower pole, and one with two heads a fission at the upper pole of the embryonal area. It is regrettable that we have no satisfactory explanation of these plausible theories.

**Characteristics.**—The placenta in unioval twins is always single; there are usually two cords, but rarely only one which bifurcates near the fetuses, and these are monoamniotic ova; the blood-vessels anastomose on the surface of the placenta, and also in the villi themselves, producing a third or intermediate circulation between the twins. The septum of the placenta never shows traces of decidua, and only two layers, the two amnions, can be found in it. The children are said to be very much alike in size and in mental and physical characteristics, but the author has not found this to be constant. Unioval twins are rare, Ahlfeld in 1157 cases finding only 15.55 per cent.

Triplets and even quadruplets may come all from one ovum, but usually two ova are concerned, one of which may bring forth two fetuses.

In length and weight twins usually differ more or less, 4 cm. and 2200 gm.

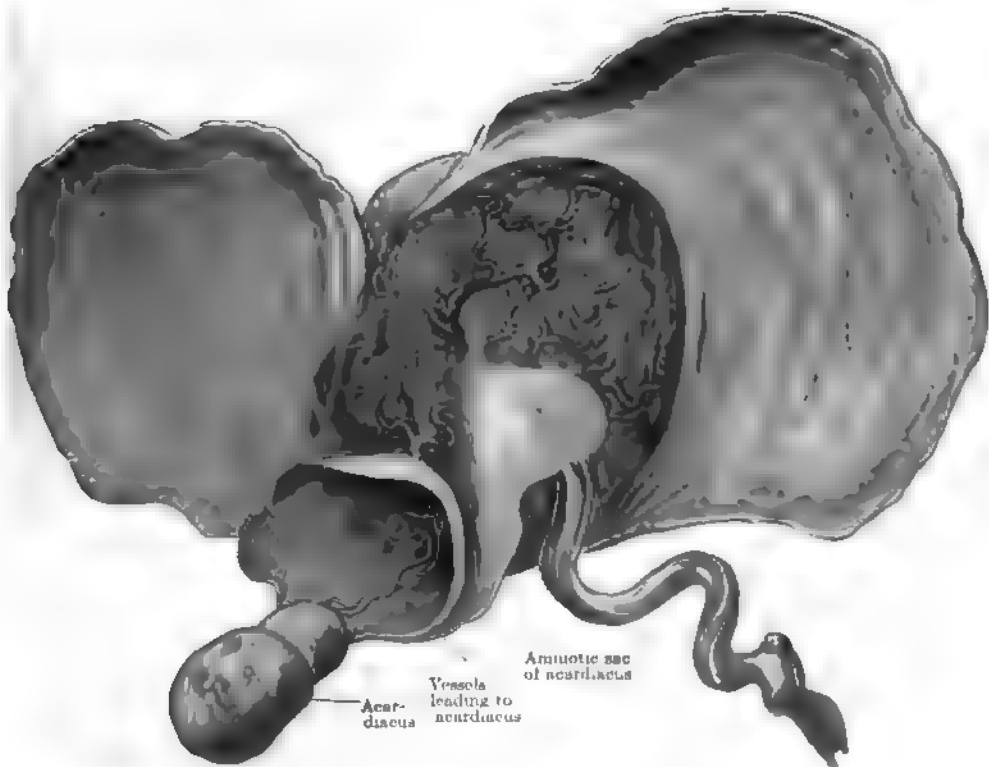


FIG. 421.—*ACARDIACTIS AMORPHA*. (Northwestern University Medical School specimen.)

being the limits respectively. Twins are usually smaller than single children, but the combined weight is greater. The same proportion of boys and girls obtains with twins as in general. Twins from one ovum are smaller than those from two, and the difference in weight is not so great; also they have a higher mortality and are more often deformed. The same deformity often exists in both twins, as in one of the author's cases, double harelip, and one of C. E. Black, rudimentary colon. It is said the tendency to this form of twins is not hereditary (Strassman). Eclampsia is more common with unioval twins. Homologous twins are always of the same sex. The two circulations anastomose in the common placenta, artery to artery, vein to vein, and artery to vein through the third circulation, the intercommunicating villus tree. The anastomosis of the two blood systems was known to Portal, who, therefore, advised the tying of the cord of the first child delivered to prevent the other from bleeding through the open vessels. As a result of this arrangement

many anomalies arise out of the unequal distribution and size of the placental vessels and unequal nutritional conditions. The heart of one child, because of its better nourishment, may overpower that of the other through the anastomotic vessels. If this occurs at an early period, the weaker heart dilates into a tortuous vessel, the fetus remains undeveloped and becomes a parasite on its stronger brother (Fig. 421). It is called an *acardiacus*. If one fetus dies after being fully developed and is long retained in the uterus, it is changed into a *fœtus compressus* (Fig. 422). Sometimes the stronger fetus causes a polyhydramnion, according to Strassman, because its hypertrophied heart and kidneys produce more urine, while the weaker suffers from oligohydramnion. Polyhydramnion is so common with twins that when it is discovered, the existence of the latter is to be suspected. If the twins lie in one amniotic cavity, the two umbilical cords may be twisted, causing the death of one or both fetuses.

Dichorionic or double-ovum twins are also subject to abnormalities. One fetus may die and be expelled, the other going normally to term. The author delivered a woman at term of twins, and she stated that five months previously she

had had, in New York city, an abortion of four months. Again the dead fetus may be retained, and the liquor amnii being absorbed, it is flattened against the wall of the uterus, a dry, shrunken mass (Fig. 422). It may present before the normal fetus, giving rise to diagnostic errors, and it may be lost in the uterus after delivery of the placenta and cause puerperal infection and late hemorrhages. The placenta of the compressed fetus is white, hard, fibrous, infarcted.

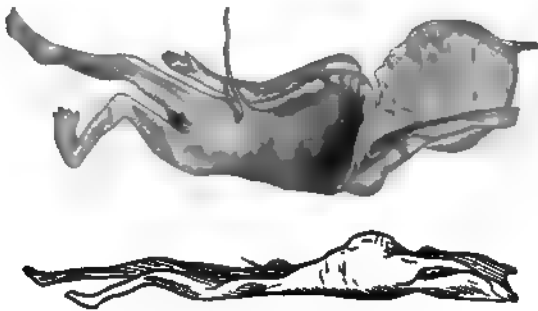


FIG. 422.—TWO VIEWS OF A FŒTUS PAPYRACEUS OR COMPRESSUS. The head of the second, well-developed child lay in the hollowed-out chest of the first one, the fetus compressus.

and demarked sharply from that of the normal fetus, and this finding on the placenta will arouse the suspicion of the accoucheur that another fetus has been retained in utero.

*Superfetation* is the nesting of a second fetus in the uterus already occupied by one in the process of development. Its occurrence has been held possible by American and French authors, while the English and German writers usually deny it. A double uterus may carry a child in each compartment, as in the cases quoted by Ramsbotham—one, where a woman, five months and sixteen days after the delivery of a living seven months' child, delivered another of full development, and another where two well-formed, fully developed boys were born three months apart. These cases should not be called superfetation. Since the decidua reflexa does not unite with the vera until the middle of the fourth month, and since ovulation occurs during pregnancy, theoretically superfetation is possible, but in most instances cannot be proved. Differences in the size of the fetuses may be explained by unequal development, but F. T. Andrews, Barry, and the author have seen specimens which prove the occurrence of superfetation in the human female. Dr. Zimmerman, of Cameron, Illinois, found a healthy ovum of four weeks, together with a healthy fetus of ten weeks, in an aborted mass. A specimen was shown to the Gynecologic Society of Chicago of two extra-uterine pregnancies of different dates which had been removed at operation. Dr. T. J. Watkins relates the case of the delivery of twins at three months and triplets at term of the same pregnancy.

*Superfecundation* is the impregnation of two different ova, about the same time, by sperms from different fathers. Its occurrence in animals is proved, but though doubted for the human, is possible. A negro woman gave birth to a black and mulatto child, after intercourse with a black and a white man. A white woman gave birth to a white and a negro child, but both these combinations may occur with only one father. To prove superfecundation we must ask, with Schultze, that a woman after intercourse with two men of different races and other than her own bear twins showing the characteristics of both sires.

**Clinical Course.** Plural pregnancy always gives rise to disturbances on the part of both mother and child. The sympathetic symptoms, nausea and vomiting, usually exaggerated; toxemia, varices, and edema are more marked; the great

listention of the abdomen interferes with the bowels, urination, and respiration, especially if hydramnion complicates the condition. Softening and relaxation of the pelvic joints are sometimes extreme, which, added to the great abdominal distention and the weight of the large uterus, make locomotion difficult or impossible. Either because the several fetuses produce too much toxin or because the kidneys are laboring under mechanical difficulties the kidney of pregnancy, nephritis, and eclampsia are much more common than in single pregnancy. Edema and even ascites may occur; indeed, a pregnancy without edema is almost positively a single one. The heart has a double burden, and, if already diseased, may fail.

About 70 per cent. of duplex pregnancies terminate before term, and practically all triplet and quadruplet gestations do so. Premature labor is caused by the overdistention of the uterus, the lower uterine segment and cervix being developed earlier than usual, and the presenting part engaging in the pelvis. According to the latest theory, labor comes on sooner because of the larger amount of ferment produced by the two fetuses, stimulating the uterus to action.

Labor with twins is often abnormal. Owing to the overstretching of the uterine muscle, the pains are weak and intermittent, labor drags on, sometimes for days, effacement and dilatation of the cervix are slow, and the parturient loses sleep and becomes early exhausted. Many peculiarities are noted in the mechanism of labor. Since the children are small and there is usually much liquor amnii, we observe frequent changes of presentation and position during pregnancy, and also during labor, sometimes produced by the delivery of one of the twins. For example, while one child comes through head first, the second changes from shoulder to breech presentation. Werth gives the following table of 1688 twin births:

Both children in cephalic presentation . . . . .	47.4 per cent.
Head and breech presentation . . . . .	34.2 "
Both breech presentation . . . . .	8.4 "
Head and transverse presentation . . . . .	5.8 "
Breech and transverse presentation . . . . .	3.6 "
Both transverse presentation . . . . .	0.47 "

The sacs occupied by the twins usually lie side by side (Fig. 425), but one may lie in front of the other (Fig. 424) or even on top of the other. In the last instance the second child during delivery has to pass through the empty amniotic cavity of the first, and the second opening in the membranes will be found in the septum. The children usually lie parallel, one on each side of the spinal column, but one may lie anteriorly and the other be entirely beyond the reach of the palpating hand. Occasionally, when the amount of liquor amnii is small, the children are dovetailed into each other, and, under like conditions, if the two

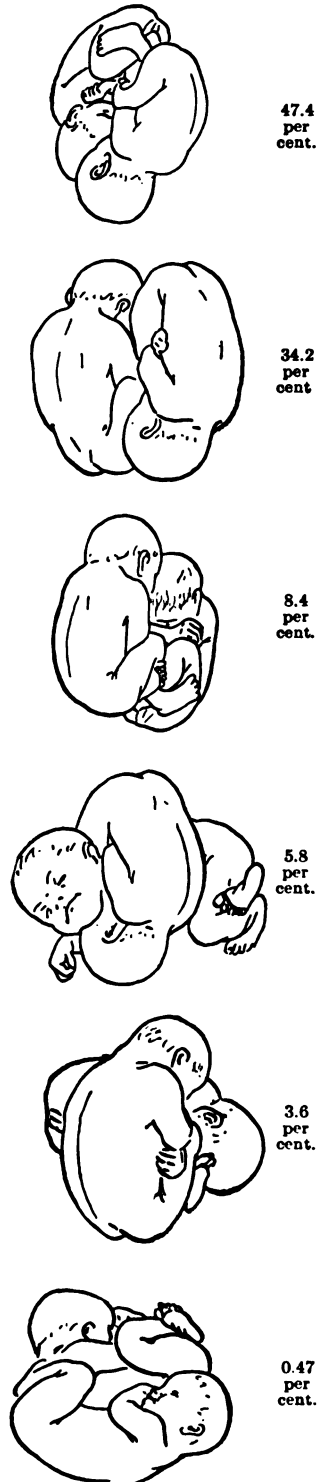


FIG. 423.—PERCENTAGE TABLE OF TWINS.

heads are apposed, they may be faceted. In one of the author's cases the flattening of the foreheads of the children was noticeable after several years.

If one placenta lies above the other, it is not rare to find the lower edge of the common placenta near or over the internal os. Placenta prævia with twins endangers three lives. Transverse and breech presentations are favored by the low implantation of the common placenta.

Owing to the shape of the uterus, the child lying in its left half usually is lower and presents and is delivered first. The uterine muscle now has a chance to shorten and get a better grip on its contents. Another bag of waters forms, ruptures, and the second fetus is extruded, usually more quickly than the first, because the muscle is stronger and there is no resistance from the soft parts. The interval between the deliveries varies from a few minutes to forty-four days (Carson). Reference has already been made to the abortion of one twin while the other was carried to term.



FIG. 424.—TWINS, ONE IN FRONT OF THE OTHER.

It is impossible to show by figures the natural interval between the two births, because, as a rule, the accoucheur hastens the second delivery. Usually the second child follows the first after thirty to forty minutes. In one of the author's cases the head of the second followed the feet of the first.

Now, the uterus contracts firmly down on the placenta, and in a small majority of cases the third stage is natural. Hemorrhage, however, is more profuse and the after-pains are harder.

**Diagnosis of Twins.**—Very rarely has the diagnosis of triplets been made before delivery. Pinard, of Paris, and Fletcher Bell, among others, did it. Twins may almost always be diagnosed during pregnancy if the examiner is sufficiently attentive. Extremely large and globular belly, rapid growth of the uterus, marked edema, albuminuria, motion felt all over the abdomen, excite the interest of the accoucheur and warn to greater care. The diagnostic points are:



1. A sulcus felt in the fundus or down the front of the uterus. This may occur in uterus arcuatus or distorted uteri, or even in ordinary labor, and may be absent in twins.

2. Unusually large and globular uterus. Must eliminate hydramnion and large child.

3. Palpation of three large parts—two heads and one breech or two breeches and one head. Make no diagnosis on the multiplicity of small parts,—the extremities,—because the child can place these in many locations.

4. When one head is in the pelvis and the distance from this to the other large part in the fundus is too great to be the length of one fetus, for example, over 30 cm.



FIG. 425.—TWINS SIDE BY SIDE.

5. Auscultation of two sets of fetal heart-tones, with these characteristics: (1) Both asynchronous with the maternal pulse; (2) they must be asynchronous with each other, the difference being more than eight beats; (3) there must be a free zone between the two areas of greatest intensity. It is best for two qualified observers to listen at the same time; in doubtful cases it is well to use a stop-watch and take the average of many counts, and during the examination the patient may not change her position (Fig. 426).

If one child is dead, this method leaves us in doubt; again the two hearts may beat synchronously for a time. The author in one such case irritated the infant until it moved, which accelerated the heart-beat. A child with straightened spine, as in the military attitude, may have heart-tones audible on both sides of the uterus, or the placenta may divide the area of audibility. Hearing two loud uterine souffles is not conclusive, nor is hearing one fetal souffle and one fetal heart-sound. During labor one may hear normal heart-tones and feel a pulseless cord in the vagina, but even this is not positive, because the cord may be compressed temporarily while the heart goes on beating. Of course, such a condition soon kills the infant.

During labor all the above signs are used, and in addition:

6. Palpation of two bags of waters (Depaul), one of which may contain a fetal part.
7. Palpation of a fetal part in an intact sac after one sac has burst.
8. Palpation of two large parts by the vaginal examination.
9. The x-ray may now be used, and its demonstration of two fetuses is positive. Edling, of Malmoe, showed three in one case.

If the diagnosis is made during pregnancy, it is best not to tell the mother, but to acquaint the father with the facts, to save the one from fear and worry and yet to protect the accoucheur from the imputation of ignorance by the other. After the delivery of one child the diagnosis that another remains in the uterus is easily made by one grasp of the fundus.

**Differential Diagnosis.**—In the early months the presence of twins may, by distorting the uterus, give rise to the suspicion of ectopic gestation. The differential diagnosis of simultaneous extra- and intra-uterine pregnancy from ordinary twins is possible only to a keen and experienced obstetric hand, and even under most favorable circumstances is rarely made before operation.

Polyhydramnion often complicates twins, and one needs to shut out ovarian tumor in these instances. (See p. 578.)

Fibroid tumors complicating pregnancy may simulate plural gestation to perfection. The absence of two heart-beats upon repeated examinations; the immobility of the supposed large and small parts; their constancy of location; the history of fibroid—usually allow prompt differentiation. After delivery the fibroids may lead to error unless the cavity of the uterus is explored.

**Prognosis.**—As was said at the beginning of this chapter, plural gestation is not normal. The disturbances of pregnancy are more common, and their fatality increased, this being especially true of the toxemias resulting in eclampsia. Heart disease complicating twin pregnancy is very serious, and usually indicates the induction of premature labor. In one of the author's cases the anasarca was tremendous, hydropleura and hydropericardium developing, the patient having hemoptysis and dying of acute edema of the lungs. Owing to the longer labors and the more frequent necessity for operative deliveries, sepsis is more likely to occur, and the operative traumatism must also be reckoned in. Postpartum hemorrhage occurs oftener, and it, with the danger of infection from the usual methods of combating it, must also be included.

For the child the prognosis is serious. Since the majority of twin births are premature, many infants die of atelectasis and general debility. A certain number of the second children are lost during the interval after the first is born, from abruptio of the common placenta, and not a few die during operative deliveries. After

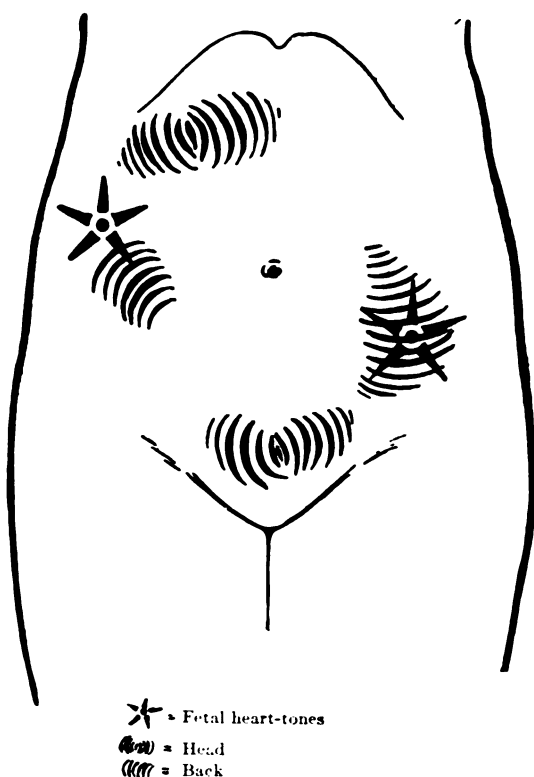


FIG. 426.—ABDOMINAL FINDINGS IN TWINS.

the mother may be too ill or too weak properly to care for them, or she may have insufficient milk, and these, coupled with congenital debility, explain the high mortality in the first year of life. Ahlfeld places it at 75 per cent., but the author thinks this is too high. Triplets and quadruplets, of course, offer much higher mortalities.

Many mothers ask if twin children are mentally and physically as strong as those of single birth. The author has carefully studied his cases and other twins,

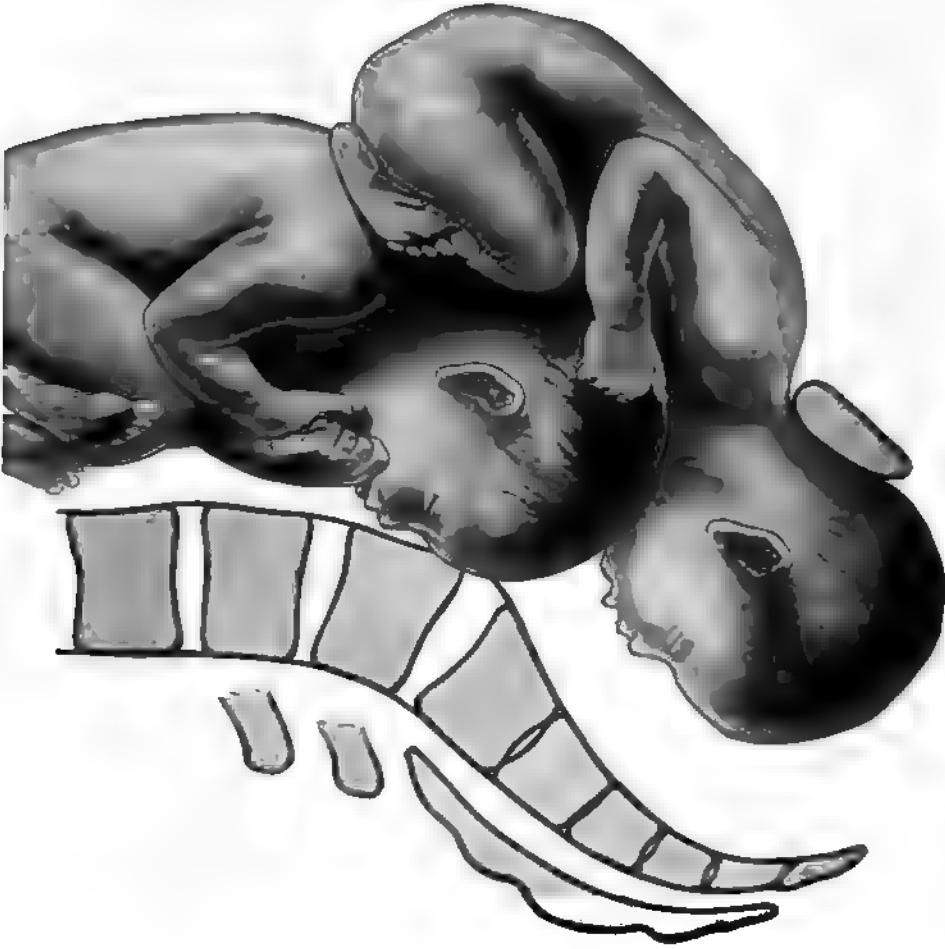


FIG. 427.—INTERLOCKED TWINS.

finds that all depends on the degree of prematurity. Where the children were well developed, no difference could be noted.

**Treatment.**—During pregnancy, a pluriparient woman requires greater watchfulness, especially regarding her kidneys and circulation. Should she abort, the accoucheur must see that the uterus is empty. Although cases are on record of the successful carrying of the second fetus to term, the frequency of infection of the partially emptied uterine cavity is so great that the danger should not be assumed so slim a chance of saving the child. During labor "watchful expectancy" is advised. One must not be deceived by the false pains of the latter weeks into assuming that labor has actually begun. Wait, if possible, for complete dilatation before rupturing the bag of waters. With frequent auscultation the accoucheur checks the welfare of the two children. It is wise not to let the first stage drag on

too long, because inroads on the parturient's strength may be regretted in the third stage, when hemorrhage may set in. Preparations for operative delivery and for the treatment of a pathologic third stage must be complete.

After the first infant is delivered a careful external and internal examination will enable the accoucheur to decide on the proper treatment. The cord should be clamped or tied on its placental end. Should the cord of the second child prolapse—should the shoulder present, immediate action is required—in short, any abnormality is to be rectified. The delivery of the second twin by version and extraction or forceps, or even simple Kristeller expression, is usually easy, because the soft



FIG. 428.—INTERLOCKED TWINS.

parts have been prepared by the transit of the first infant. For the same reason the head of the second infant is not molded. If the heart-tones are normal,—and one should listen constantly,—if there is neither external nor internal hemorrhage, one may safely wait for twenty minutes before rupturing the second bag of waters. This interval allows the uterus to gather strength for the expulsion of the second child, and is also a safeguard against postpartum hemorrhage. One may strengthen the pains with pituitary extract for the delivery of the second twin.

Owing to the overdistention of the uterus, contraction and retraction of its muscle are poor and the tendency to postpartum hemorrhage is augmented. Accurate control of the fundus and gentle massage are indicated, and expression of the placenta is usually needed earlier than in single labors. Ergot and hypophymin

should be given as soon as the placentas are born, and the former repeated in smaller doses for a week or more, because involution of the uterus is slower. The accoucheur should remain in the house several hours to be certain that no relaxation of the uterus may occur, and to discover any tendency to postpartum eclampsia.

**Anomalies of Plural Births.**—(1) Pathologic presentations—shoulder, breech, brow, face, anterior parietal bone, etc.—occur in a goodly percentage of cases, and are treated on general principles.

(2) The part presenting may change several times before one finally engages and is delivered. Watch for pathogenic delay, then interfere.

(3) The bag of waters of the second child may rupture before that of the first, or the two may rupture at one time. No treatment is necessary in the first instance unless the cord of the second child prolapses before the presenting part of the second is delivered. If conditions for extraction are filled, deliver both children, otherwise replace the cord.

(4) Rarely the placenta of the first twin is delivered before the second is born. If the placenta is independent of the other, no harm results from this, but if the two are united, the necessary abrupture of the placenta of the second child will be fatal to it unless it is delivered at once. The signs of asphyxia and external hemorrhage apprise the accoucheur as to what is going on. Rapid delivery of the second child will save it, and also preserve the mother.

(5) The transit of the first child may alter the position of the second, for example, from longitudinal to transverse, from vertex to face. Treatment is on general lines.

(6) Interlocking or collision may occur. The two heads may try to enter the pelvis at the same time, or one head enters, while the second head, caught in the neck of the first twin, attempts to enter with it (Fig. 427). If the children are small, such a mechanism is possible. Or the head of the second fetus enters the pelvis after the first one, presenting by the breech, has been delivered as far as the neck (Fig. 428). The second child, coming as a breech, may straddle the first in shoulder presentation, or four extremities may present, the two breeches entering the inlet at once.

Delay in the delivery of twins should always excite the suspicion of locking, and an examination with the whole hand, in narcosis, if needed, is to be made. Much can be accomplished by manipulation aided by the steep Trendelenburg position, especially if the uterus is paralyzed by deep anesthesia, and the children may be disentangled, one of them being led into the pelvis. Should interlocking, as in Fig. 428, occur, a deep episiotomy is done, to avoid complete laceration of the perineum, the whole hand inserted, and the second head pushed up and out of the pelvis. If the heads are small, such a procedure is possible; if not, one should decapitate the first child quickly and push its head up into the uterus, then deliver the second with forceps. In such a case Lobenstine did a cesarean section and saved both twins and mother. Forceps or the cranioclast may be applied to the second child, delivering it first, but one should attempt to save at least one of the children by disentangling them under deep anesthesia. If the first one is dead, there is no occasion for hurry.

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## CHAPTER XXXVI

### PROLONGED PREGNANCY AND MISSED LABOR

REFERENCE has been made to prolonged pregnancy (p. 116), and here will be considered the pathologic side. Labor occasionally begins at the proper period, some degree of dilatation is attained, but for some reason the pains cease and gestation continues for from two to four weeks, when the uterus again is set in action and delivery is accomplished. This occurrence must not be confounded with the pains and changes in the cervix which sometimes occur at "lightening." When the child is thus carried over term, it undergoes certain alterations; the length increases disproportionately to the weight, the head enlarges, and the bones harden, the parietal bosses becoming prominent and pointed. The body is less fat and is firmer in consistence; the spinal column is harder and less flexible. In some cases the fetus is overgrown in every way. Oligohydramnion, with its consequences, may occur. The child may die without other cause apparently than being overripe, and this fact is known and appreciated even by the laity.

During labor I have observed these anomalies:

1. Lack of cephalic molding, from the extreme ossification; high arrest of head; prolonged and fruitless labor; forceps—hard extraction; extensive injuries; stillbirths.
2. Occipitoposterior positions, absent rotation, etc.
3. Deflexion attitudes—military attitude, forehead, brow, and even face presentations and their sequelæ.
4. More or less disproportion between the size of the passage and the passenger, prolonged labor, and operative interference.

Many irregularities in the labor apart from the above have been observed. Some of these are indirectly caused by, or indirectly influence, the mechanical factors in labor. The pains are apt to be irregular, intermittent, and ineffectual. Occasionally, on the other hand, they are tumultuous and quickly deliver the child, perhaps precipitately, injuring it or the mother. The writer had one case of complete spontaneous rupture of the uterus where the pregnancy was prolonged and labor rapid. This is the exception. Weak pains are the rule. It is possible that a fatty degeneration of the uterine muscle occurs in these weeks of prolonged pregnancy (Bossi). This invites traumatic rupture or produces inertia, necessitating the use of forceps. The lack of strong uterine contractions leaves the cervix and vagina without the softening and succulence necessary for the safe dilatation, and, therefore, lacerations of the parts are frequent and all operative intervention is rendered laborious. The same inertia is carried over into the third stage, and postpartum hemorrhage caps the climax to the succession of complications.

While these accidents are by no means the rule in women going over term, they occur so often that the question of methodically inducing labor at the normal end of gestation deserves grave consideration.

**Prolonged labor** is a peculiar condition. Pains begin, the cervix becomes effaced and opens, the show appears, even the bag of waters may rupture, but delivery does not occur. I have seen the os open to the size of the palm, but retract and pregnancy continue. However, intermittent pains declare that the woman is in labor. In a case sent to the author from South Dakota the woman had been in actual labor for eight weeks and came to the maternity in a typhoidal condition.

dilatation with the colpeurynter, cervical incisions, and forceps procured a 4½ pound emaciated infant which survived. The process was repeated in a subsequent pregnancy. Occasionally labor may be completely interrupted and resumed at a later period—perhaps at the end of a menstrual cycle.

The causes for these conditions are unknown—perhaps some disease of the uterine muscle or of the nerves of the uterus or lack of endocrine gland action should be invoked. I have noticed that my cases go over term in groups, and that other practitioners are having the same trouble about the same time. This fact Bossi also mentions, and he found that the condition recurred and was hereditary. Oldrimiparæ, women who have had dysmenorrhea, and in whom the pelvis is of masculine type, seem oftenest affected. Fibroids have been noted in several cases. A peculiar circumstance in these patients is that, when fever begins, which is not unusual, especially if the bag of waters is ruptured and the vaginal bacteria have gained access to the uterus, the pains begin or become stronger, and delivery is completed rapidly. After delivery the temperature rapidly becomes normal.

**Treatment.**—The author does not consider it good practice to allow gestation to continue long after its natural term has passed, and, likewise, it is not safe to permit a protracted labor to wear out the woman's strength, as it is bound to do in time, through loss of sleep, much suffering, and anxiety. If labor does not set in on the day which, after careful computation, has been set for it, the accoucheur makes a careful examination of the gravida. Since the fingers are to be passed into the uterus, the preparations of the patient and for the patient should be identical with those of actual labor, that is, shaving, disinfection, rubber gloves, etc. The accoucheur determines the size of the infant, using cephalometry, the degree of engagement of the presenting part, and the state of the cervix. When convinced that the end of normal pregnancy is reached, he informs the woman that unless pains begin within a week it will be deemed wise to inaugurate labor. This is best done by packing the lower uterine segment and the cervix with gauze (p. 1052). Pains are usually easily set up, because the irritability of the uterus has been developed; indeed, the ease with which uterine contractions are elicited indicates the nearness of the gestation to term. Very often just sweeping the fingers around the internal os and slightly separating the membranes set labor in progress. Gill Nylie recommended a dose of castor oil and 10 grains of quinin, which I have employed with some success. Pituitrin has recently been used, 3 minims hypodermically every two hours, but rarely succeeds.

**Missed Labor.**—This is a term applied by Oldham to the retention of a fetus, dead, near term, in the uterus. Missed labor often occurs in cows and sheep. An attempt may or may not have been made by the uterus to expel its contents. The condition is similar to the one just considered, except in the death of the child, which is often inexplicable, and is the same as "missed abortion" (p. 450), only occurring later in pregnancy. The reason for the failure of the uterus to expel the dead product of conception has been placed in a rigid cervix, for example, cancer, scars, hypertrophy, a diseased uterus, myomata, muscular degeneration, cornual pregnancy, low insertion of placenta, adherent membranes, peritonitis with adhesions, and nervous disease. After the fetus dies it mummifies and shrinks up, its liquor is absorbed, and the uterus applies itself closely to the body. A lithopedion may form, as in extra-uterine gestation, or infection, with purulent disintegration and extrusion of the bones of the skeleton through the cervix, or by ulceration through neighboring cavities—a termination which is excessively rare. Usually it interferes and empties the uterus. In Menzies' case the dead ovum was carried to the seventeenth month, and in Hening's case, eight months after term.

**Symptoms.**—One finds the same symptoms here as in missed abortion (*q. v.*), but exaggerated. The woman complains of the feeling of a dead and heavy mass

in the belly, and notes the absence of fetal movements. Pains of a parturient character occasionally occur, commonly at the time of the customary menstrual periods, and it is at such times that labor often sets in.

Examination shows a closed cervix, and a thin-walled, torpid uterus, of ha consistence, entirely lacking the spongy softness characteristic of normal pregnancy. The diagnosis is easy. Since the question of pregnancy is seldom uncertain, all that is needed is to prove that the symmetric tumor is the uterus and that it does not grow. On p. 272 are the points for the determination of the life or death of the fetus.

**Treatment.**—If the child is dead, the bag of waters intact, and the patient is ill, it is advised to wait for the time of a monthly period or two to see if nature will not start the pains and empty the uterus. In the interval the woman must be enjoined not to have intercourse nor to take douches. Some authors advise the emptying of the uterus when the diagnosis of missed labor is positive, and with this I agree, because the uterine contents may become infected while waiting and this renders an otherwise safe operation extremely hazardous. The torpidity of the uterine muscle in these cases is sometimes astonishing—one may use all sorts of local irritants—gauze, colpeurynters, etc.—for days without evoking pains. It is therefore, the author's practice to incise the cervix or do vaginal cesarean section if the uterus proves refractory after forty-eight hours' trial. Since the fetus is dead, craniotomy and morcellation are indicated to save the maternal soft parts from injury. If the mass is already infected, the case is treated as a septic abortion with tampon and morcellation. If the fetus is of considerable bulk, laparotomy and complete extirpation of the uterus might be simpler than the attempt to remove the mass from below. If delivery from below seems better, vaginal cesarean section is performed and morcellation of the fetus if necessary. The field is exposed by broad retractors and the wound left open for drainage, to be repaired at a future time. v. Winckel advised a more expectant treatment of these infected cases, i. e. drainage of the uterus, lightly disinfectant douches, removal piecemeal at different sittings of parts of the fetus and secundines, the process taking weeks and sometimes months.

**Graviditas Exochorialis.**—Among the rare conditions met with is the development of the fetus in the uterus, but outside of the chorionic cavity. In such cases the amnion is also torn, the membranes shrink up, the liquor amnii continually escapes, sometimes in large amounts, and the fetus may show the results of oligohydramnion—contractures, club-feet and arms, decubitus, etc. The differential diagnosis must be made from hydrorrhœa gravidarum (q. v.). Abortion is frequent.

In *graviditas examnialis* the amnion is burst, but the fetus is still surrounded by the chorion. The amnion is found retracted around the fetus.

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## CHAPTER XXXVII

### DISEASES ACCIDENTAL TO PREGNANCY

A PREGNANT woman is not immune to any disease which may affect her in the non-pregnant state, and, contrary to the old notion, she is more susceptible to some. Pregnancy in general aggravates the diseases which occur, and in turn the gestation is endangered by them. Abortion or premature labor occurs with varying frequency in all the infectious diseases, and also often complicates the course of constitutional, circulatory, respiratory, alimentary, and kidney affections. It is obviously impossible, in a book of this size, thoroughly to consider all the maladies from which a pregnant woman might suffer. Only the salient points of large groups, and especially important features of individual diseases, will receive mention. The reciprocal influences of pregnancy upon the disease and of the disease upon pregnancy will be studied in turn.

#### THE ACUTE INFECTIOUS DISEASES

Typhoid, typhus, measles, scarlatina, variola, erysipelas, diphtheria, cholera, malaria, influenza, pneumonia—all occur in pregnancy, and most of them have a very deleterious effect on both mother and fetus. The action of these diseases is twofold: first, they endanger the woman through hyperpyrexia, increased toxemia, the accompanying nephritis, and through the tendency to become hemorrhagic. Profuse menorrhagias are often noted, some of which may be early abortions, and a differential diagnosis may have to be made from several conditions. For example, a young woman was sent to the author with a diagnosis of septic abortion with profuse hemorrhage. She was in the first week of typhoid, with epistaxis uterina, and was a “virgo intacta.”

Women who have had an exhaustive siege of disease are in poor condition to withstand the pain, shock, and hemorrhage of abortion or labor, and collapse may come on in the third stage. This is especially true when the lungs or heart are much involved. Finally, some of the above-mentioned diseases lead directly to puerperal sepsis, either by blood or regional transmission of the bacteria, or by so reducing the immunities of the patient that infection easily gains foothold. Examples of these are variola (infection from the pustules), typhoid (the streptococci from Peyer's patches, and even the typhoid bacilli themselves), influenza (direct), erysipelas (direct), scarlatina (from the throat), pneumonia (direct), diphtheria (direct), etc.

Second, these diseases interrupt pregnancy, which is due to a not infrequently accompanying hemorrhagic endometritis and to the death of the fetus. Fetal death is brought about in various ways:

(a) The fetus may die from insolation. Normally, the temperature of the fetus is one-half a degree higher than that of the mother, and since it has its own heat-regulating system, it can take care of the ordinary changes, but when the mother is hyperpyretic, the child cannot do so because it has not the means to discharge heat, as by evaporation, for example. High temperature, especially a sudden rise, is, therefore, less well borne. Runge and Doré showed that a gradual rise to 104° F. is fairly well borne, and unless continued thus for a long period, is usually survived by the infant. The movements and the heart-tones are at first increased, later slowed, and death occurs. Rabbits will stand a very gradual rise to 109° F., but if it is sudden, it is always fatal. Krummaker reported a case of hysteric fever with sudden rises of 109.4° F. at intervals for seven days without effect on the child.

(b) Pregnancy is interrupted by the hot blood circulating through the uterus. This is not improbable, because heat applied to the abdomen and by hot douches causes the uterus to contract, and clinical experience in delayed labors shows that when the temperature rises, as from sepsis, the pains grow stronger.

(c) The fetus dies from *asphyxia*, brought about—(1) By low blood-pressure of the mother and consequent stagnation of the circulation in the uterine sinuses; (2) the same, because of profuse hemorrhages; (3) from hypercarbonization and deoxidation of the mother's blood, the direct result of the disease, for example, pneumonia; (4) from a hemorrhage in the placenta with separation of the organ; and (5) because of fatty degeneration of the fetal villi, which renders the respiratory exchange of gases in them impossible.

(d) The child may acquire the disease from which the mother is suffering or it may die from the toxins which it receives from the maternal circulation. The villus-wall offers no hindrance to the passage of the toxins, which, like other poisons, strychnin and potassium iodid, are known to go through, as also do antitoxins, for example, diphtheria. The villus is no barrier to the passage of the bacteria—they either pass through directly or after destroying the wall, and lesions of the latter are not hard to find. These infections have been demonstrated in the fetus: variola, measles, scarlatina, typhoid (the author in 1891), cholera, pneumonia, bubonic plague, erysipelas, pus infections, anthrax, tuberculosis, syphilis, febris recurrens, malaria. It is remarkable that in some of the diseases the child is not at all affected, and the author has had cases where the child alone was ill, the mother remaining free. Others have noted such an occurrence in smallpox.

**Typhoid.**—It is said that typhoid is rare in pregnancy. Freund found 42 cases in 3272 typhoids, which is not excessively rare when all the facts are considered. The Eberth bacillus and the Widal reaction have been found in the fetal blood, especially in the latter months of gestation. Pregnancy is interrupted in two-thirds of the cases, especially in the early months. Children of the later months almost always die after birth. Hemorrhage is usually not profuse, but the accoucheur is warned to prevent all bleeding because of the exhaustion of the patient. The soft parts are very easily torn, but bleed little. Union was good in the author's three cases. The mortality is higher than in uncomplicated typhoid. In the puerperium the differential diagnosis is most important, since the fever is usually ascribed to puerperal sepsis. The gradual rise of fever, the absence of chills, the slow pulse, the tendency to apathy, not excitement, the early splenic tumor, the stool, the roseola, and the negative findings on the genitalia usually enable the proper course to be taken, but one should always try the Widal reaction, and, if necessary, make a culture from the blood. A typhoid puerperal infection is not impossible, and typhoid may be combined with putrefactive and purulent infections.

**Variola.**—In the majority of cases of smallpox abortion or premature labor occurs, and the child almost always dies. It may be born pock-marked, as was the accoucheur Mauriceau, or in the eruptive stage. Confluent and hemorrhagic variola are more common in gravidæ, and the mortality is, therefore, much higher (Vinay, 36 per cent.). Sepsis may arise from the pustules, and after recovery from the smallpox a recrudescence of the fever may occur from the resorption of toxic material from the fetus, which disappears when the uterus is emptied. Hemorrhage during labor is greater. Vaginal examination and intra-uterine manipulations are to be avoided, as far as possible, because of the danger of introducing infection.

Vaccination during the disease not always protects the child, which may be infected during delivery or afterward (isolation for the healthy child). Vaccination of the child should be done immediately on delivery, but it usually does not protect. Women who have been vaccinated or who have had variola during pregnancy give birth to children which later are immune to vaccination and smallpox (Kollock and Sawyer). On the other hand, vaccination of the mother sometimes has no protective influence on the child. Franklin reports a case where the father had smallpox; the mother, vaccinated, remained well, but the child was born dead of smallpox, which shows that the child received the contagion through its healthy mother. Pridham observed the same mode of transmission of varicella.

**Scarlatina.**—Pregnant women seldom get real scarlatina (Ballantyne), but erythematous lesions which resemble it, due to sepsis, are not uncommon, especially in the puerperium. The relations of scarlet fever to sepsis are not yet decided upon, and

will not be until the exciting cause of scarlatina is known, but probably the streptococcus has something to do with both diseases when a connection between the two is suspected. The child may have scarlatina, the mother remaining well (Liddell). The author knows of many instances of labor occurring in the same room with children suffering from scarlet fever and has seen no trouble arise therefrom. Of course, precautions were taken, but these could not always be complete, and often were largely neglected. The mortality of scarlatina in the puerperium is given as from 5 to 52 per cent., and the frequency of puerperal ulcers, parametritis, and puerperal infection in general as complications is emphasized (Tornery).

In the puerperium, unless an epidemic of scarlet fever is raging, it is best to consider the scarlatiniform eruption as due to infection, unless the other characteristics of the case stamp it distinctly as scarlet fever.

**Measles.**—Fellner collected 30 cases from the literature. Measles is a serious complication of pregnancy, as it generally is in adults. Gestation was interrupted in 55 per cent.; the general mortality was 15 per cent.; during the puerperium two of three women died. Sepsis explains the high mortality. The children are usually affected by the disease and show the eruption, as the one of Clarus did when removed by cesarean section from the dead body of its mother. In the service of the Chicago Lying-in Hospital Dispensary many of the puerperæ are exposed to this contagion from their sick children, but in no case has measles developed, which shows that even the imperfect isolation possible in the homes of the poor will suffice to protect. In one of my cases the child developed typical measles on the tenth day, the mother being free.

**Cholera.**—In the Hamburg epidemic of 1892, 57 per cent. of pregnant women affected by cholera asiatica died (Schütz). Abortion was very frequent because of hemorrhagic endometritis. The disease usually is not, but may be, transmitted to the child.

**Erysipelas.**—When this disease attacks any other portion of the body than the genitalia, it seems to be less dangerous, but many records are at hand to show that puerperal infection may result in such cases. The author delivered a woman suffering from facial erysipelas; shortly after birth the vulva became red, and she died under the picture of acute sepsis. At the autopsy, from the very little clear peritoneal fluid, a pure culture of *Streptococcus pyogenes* was recovered. A facial erysipelas is not invariably transmitted to the genitalia. Pregnancy is not often interrupted by erysipelas, and frequently the children are delivered alive, but they may have the disease. The mortality is increased. Late literature on the subject is scarce (Lebedeff).

**Sepsis.**—Under puerperal infections the usual forms of sepsis will be considered at length. Here might briefly be mentioned infections of distant portions of the body, for example, mastoiditis, frontal and other sinusitis, tonsillitis, abscesses, cellulitis, anthrax, and tetanus. These diseases are usually aggravated by pregnancy, and their bacteria may be transmitted by way of the blood-stream to the uterus and the fetus. It is possible, too, that direct transference of the virus may be effected by the woman herself with her fingers. A local infection of the uterus and fetus may occur at any period of gestation and cause abortion. The author is convinced that coitus in the latter weeks often causes labor to set in, and may be followed by serious puerperal infection.

Pregnant cows may suffer from infection by the *Bacillus abortus*, which gains entrance through the mouth and lungs. Contagious abortion in cows has already been mentioned. The abortion is attended by fever, and sterility may result. The bacillus may be demonstrated in the milk for years afterward.

**Malaria.**—Mild cases of malaria exert little influence on gestation. Severe cases may interrupt pregnancy through fever or cachexia. Labor may change the

type from tertian to quotidian. Williams could not find the plasmodium in 15 infants when it had been demonstrated in their mothers, yet Bodenhäuser reports a case of such transmission, and fetuses have been delivered with enlarged spleen and pigmentation. During labor an attack may occur. Uterine action is torpid. Hemorrhages have been noted postpartum. The author had a case of hemophilia which seemed to be malarial in origin. Lardier speaks of hemorrhage in labor, and Legeois and Barker of bleeding later in the puerperium. Postpartum malaria seems to be a little more serious than usual, but its chief interest is in the diagnosis. Practitioners in malarious regions find many times that an outbreak of malaria occurs in the puerperium in a manner similar to that of a fresh attack after an operation. In such cases puerperal infection is to be excluded and the plasmodium demonstrated. Quinin is to be administered whenever indicated (Fry, Deale).

**Influenza.**—Owing to the variations in the severity of influenzal epidemics and pandemics, and the difficulty of differentiating the milder cases from ordinary catarrhal affections, the reports of observers differ as to the effect of la grippe on pregnancy. The gastro-intestinal form of la grippe in pregnancy is not always attended by hyperpyrexia. The excessive vomiting may raise the suspicion of hyperemesis gravidarum. In the nervous forms eclampsia should be thought of, though these varieties are very unusual in gravid women. The respiratory grip is the most serious in pregnancy, and if attended with marked toxemia, may lead to its interruption, usually through uterine hemorrhage and endometritis. The severe cough, dyspnea, and insomnia are exhausting. During labor the uterus is tender and inactive, and operative interference oftener indicated. In the puerperium influenza is not rarely the cause of fever, and it is frequently difficult to decide if there is not, in addition, a puerperal infection. Streptococcic invasion of the uterus after la grippe is not unknown. In 1916 an epidemic of la grippe in the Tarnier Maternité in Paris killed 6 of 18 patients affected. In 4 of these the death seemed to be due to septicemia and peritonitis (Chomé). Stoltz found decomposition of the lochia in 50 per cent. Subinvolution is common, and lactation retarded. Pneumonia, pleurisy, meningitis, and sinus suppurations occur with double the frequency of the normal state. Rarely is the fetus affected, excepting in those epidemics attended by high mortality and a large percentage of abortions. The treatment is along general lines. Labor is not to be induced unless cyanosis, dyspnea, or threatening respiratory or cardiac failure indicate it. The bag of waters is to be ruptured, a colpeurynter to be applied, and as soon as the cervix will permit it, extraction is to be effected. The patient should not be allowed to labor long nor to bear down much—both are exhausting. Preparations similar to those for treating heart disease are to be made (Möller).

**Pneumonia.**—Pneumonia must be considered one of the specific infections, with localization in the lungs, and it acts in many ways like most of the diseases described in this chapter. Pregnancy is interrupted in more than half of the cases, especially if it already is in the latter months. Cyanosis and dyspnea are more marked, especially in the last few weeks, when the excursions of the diaphragm are restricted by the large uterus, and particularly if the abdomen is tympanitic. Cardiac collapse is earlier and more frequent; indeed, pregnancy and pneumonia are a dangerous combination. Vinay collected cases which showed a maternal mortality of 68 per cent. when pregnancy was interrupted, and of 15 per cent. when it went on undisturbed. Pneumonia may affect the fetus, and its chances generally are not good, though Fellner quotes 19 cases of Schauta's clinic, with only 1 death. One should not induce labor except for threatening symptoms of cardiac or respiratory collapse, the same rules guiding here as were mentioned under Influenza. The old methods of emptying the uterus are to be selected.

Pneumonia in the puerperium may be due to the pneumococcus, may result from the anesthetic (bronchopneumonia), or be hypostatic or embolic. The last two

rms appear in septic cases—the one from cachexia and the other from embolism from infected pelvic veins (*q. v.*). Other manifestations of pneumococcus invasion are: Pleurisy, pericarditis, endocarditis, meningitis, otitis media, sinus infections, endometritis, and ophthalmia neonatorum, besides other fetal infections.

For further information on all these subjects see Fränkl-Hochwart and v. Noorden.

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## CHAPTER XXXVIII

### THE CHRONIC INFECTIOUS DISEASES

**Pulmonary tuberculosis** has a marked influence on the woman during the performance of the reproductive function. In the advanced cases ovulation and menstruation are usually suppressed, which may be looked upon as the conservative effort of nature, as the result of extreme cachexia with atrophy of the ovaries, or of local tubercular disease of the genitalia. In beginning tuberculosis amenorrhea or scanty menses may be noted, and since the girl may be chlorotic, a difficult diagnostic problem may present itself—chlorosis or tuberculosis, or both. Every chlorotic girl's lungs should be carefully examined. A leukorrhea may substitute the menses in such cases.

Sterility, fortunately, is not rare in tubercular men and women, but only in advanced cachectic individuals. Pregnancy does not confer immunity on women against the disease, as was once held; on the contrary, conception may arouse a latent affection, or even develop it in an individual who only displayed a tendency to become tubercular. An existing pulmonary disease is apparently benefited by pregnancy, the gravida developing red cheeks, a lively expression of countenance, with clear eyes, and even rarely putting on fat, but, withal, the consolidation is making rapid progress, and after delivery caseous degeneration will occur more rapidly than before. Ordinarily, the disease makes deep inroads during gestation, and the author has noticed this occur especially if the woman also suffers from hyperemesis. If a dormant tuberculosis awakens in pregnancy or a new infection occurs, the course of the disease is apt to be more rapid, being usually of the more florid type, the tendency to fever greater, and emaciation more marked. Hemoptysis occurs in 50 per cent. of the cases. Tuberculosis of the larynx, heart disease, and nephritis aggravate the pulmonary condition decidedly. The chronic ulcerative varieties of tuberculosis do not usually produce such marked symptoms during pregnancy, the author having seen such women bear children repeatedly, without greater aggravation of the disease than one would expect under other circumstances.

The puerperium also has a deleterious influence on the disease. Owing to the changes in the lungs and heart and the drain on the system caused by pregnancy and labor, especially if there has been much hemorrhage, the caseous deposits soften and rapidly break down, hectic develops, and the course of the affection goes downward fast. If the patient has tuberculous laryngitis in addition, she rarely survives the puerperium (Küttner, 90 per cent. mortality).

Pregnancy is rarely interrupted, and then the infection is usually very florid, and resembles a pneumonia more than a typical tuberculosis.

During labor the degree of involvement of the lungs will determine how much trouble will be met. Mild cases go through it without causing anxiety. Advanced cases are harassed by dyspnea, cough, occasionally hemoptysis, and threatened by cardiac collapse, oedema pulmonum, pneumothorax, and, rarely, a spread of the infection into general miliary tuberculosis. Labor is slower, and the second stage is prolonged and critical. During the puerperium fever is common; a bronchitis is often added to the other troubles, but, in the author's experience, sepsis has not been more frequent. The differential diagnosis from sepsis is easy.

Tuberculosis has decided immediate and remote influence on the child. Birch-Hirschfeld (1891) first demonstrated tuberculosis in the fetus, and Schmorl showed it in the placenta in 50 per cent. of the cases, though Hardy, in 1834, mentions it

enz, Lit.). Bar and Renon found tubercle bacilli in blood of the umbilical cord in 2 of 5 cases. Placental tuberculous foci usually precede fetal disease, but without doubt the bacilli may pass directly to the fetus through the walls of the villi. Congenital tuberculosis was held impossible for years and by many, but it occurs, and probably more frequently than is generally known. Friedman injected weak suspensions of tubercle bacilli into the vaginas of recently impregnated guinea-pigs and produced fetal tuberculosis. By men, through dirty habits, or from genital tuberculous foci, the bacilli could be introduced with the semen. Baumgarten held that the disease was inherited, the germs developing at a later period, but probably a weakness of the constitution, a tendency to the malady, is inherited, and the environment of the child and the numerous opportunities for infection are the exciting causes.

The children of tuberculous women may be large and robust, especially if the disease is of the chronic type. Puny children also are born, and many die in the first weeks or months. The author knew a family in which six children died consecutively of tuberculous meningitis. It is possible that the child becomes tuberculous through the mother's milk.

*Treatment.*—Women with tuberculosis should not marry—first, because this aggravates their own disease; second, they may infect the husband; and, third, they propagate tuberculous children. The same is to be said of the husband.

If the tuberculosis is latent, or if the candidates possess only the hereditary taint, the question is more difficult, but it is only exceptionally that the doctor's advice is asked. Knowing the tendency for a latent tuberculosis to break out in pregnancy, marriage is to be forbidden. If the woman marries, she should avoid conception. Finally, if she conceives, she should not nurse the baby. The disease makes great progress during the puerperium, especially if the woman nurses. The tuberculin tests may be made on gravidæ.

During pregnancy the recognized medical treatment is carried out. Should a pregnancy be interrupted because the mother has pulmonary tuberculosis? Opinions differ, three positions being held: one, that pregnancy be always interrupted as a curative measure; another, that it be never interrupted, and the third, that the cases be individually treated and the gestation brought to an end only when certain symptoms indicate it. I am inclined to a more active treatment. If tuberculosis of the lungs is manifest early in pregnancy; if there are fever, wasting, many bacilli in the sputum, hemoptysis, and advancing consolidation,—that is, the process seems to be florid,—abortion should be induced without delay. Trembley, of Saranac Lake, induces abortion in the early months in all cases, and says that the mortality and percentage of relapses are practically nil when abortion is induced before the end of the third month. Morris, from a study of 1000 cases, came to similar conclusions. If the process seems very chronic, especially if the patient comes in the second half of pregnancy, it is justifiable to wait and watch closely.

If the pregnancy is near the period of viability, one may tide the woman over a few weeks for the sake of the child, or even allow her to go to term, depending on her condition. Urgent symptoms of cardiac nature, persistent hemoptysis, and dyspnea may require the emptying of the uterus. Complicating nephritis, heart disease, and contracted pelvis, which is said to be more frequent in the tuberculous, will give earlier indication for interference. Tuberculosis with hyperemesis makes the indication for immediate abortion.

Laryngeal tuberculosis in the early months is a positive indication for abortion; in the later months one may temporize, unless obstructed breathing forces the hand. Be ready to do tracheotomy. In tuberculous cases anesthetics are used only when very necessary. Abortion may be done in two sittings: the first, for packing the uterine cavity with gauze, after opening the ovum, and the second on the day following, for removing the contents of the uterus, unless these have come away sponta-

taneously. Local anesthesia with novocain is used wherever possible. General anesthetics are dangerous because they aid in spreading the disease in the lungs. Premature labor is performed by rupturing the membranes and metruorrhagia, unless great urgency necessitates more rapid operating, when vaginal cesarean section may be done. Bumm recommends extirpation of the uterus at this opportunity, often tying off the tubes to procure sterility. During labor the general course is expectancy, but armed for all emergencies. The heart has been poisoned so long, a subcyanotic condition of the blood has existed so long, that the cardiac muscle is likely to be diseased; therefore to it we give our main attention. As soon as dilatation is complete and the head on the perineum, forceps are to be applied, unless the woman's condition is so good that interference is unnecessary. The hemorrhage of the third stage is to be limited. The author has used ether in these cases with no worse effects than follow chloroform, but is sparing with it. In the puerperium one should keep up the heart with caffein, strychnin, and digitalis, but especially good are fresh air and full diet. Lactation is forbidden, and the child should be removed from the environment in which it was born unless the parents are intelligent enough to carry out the necessary precautions for its safety. The woman should be instructed how to avoid pregnancy in the future. Something must be done until the woman is cured of her tuberculosis, so that she may safely go through a confinement, because every accoucheur recoils with horror from the task of repeatedly doing abortions on these tuberculous women. (See Bacon.)

**Syphilis.**—Obstetricians should constantly be on the alert for this protean disease. Its baneful action is often discovered when least expected, and it spreads its blight on all three individuals concerned in the propagation of the species, even being transmitted to the second generation. Ricord says that in Paris one in eight is syphilitic, and while in America the conditions are better, the disease is not rare, and in its lesser manifestations quite common, though often not diagnosed. R. Peterson found 5.6 per cent. of routine gynecologic and obstetric patients were luetic. First maternal syphilis, then paternal, will be considered.

*Effects of Pregnancy on Syphilis.*—If a woman acquires lues at the same time that she is impregnated, or if she conceives while still in the florid stage, the disease assumes graver forms than in the non-pregnant. The chancre is larger than usual, hypertrophies, is more moist, vascular, and soft, and shows a tendency to ulcerate or become phagedenic. It lasts longer, and may often be found even after twelve weeks. Secondaries develop sooner and are more marked, especially those on the genitalia, because of the natural succulence of the parts. The exanthem is very wide-spread; the papules are likely to be large, and pustular forms are commoner. More tumefaction of the glands is observed, and they tend more to suppuration. Eroded papules are very numerous on the vulva (Fournier); "they develop with a singular exuberance, take on quickly a granulating condition, hypertrophy, and often constitute veritable tumors, which invade and deform the entire vulva. Further, they are always more rebellious to treatment, being reabsorbed slowly and with difficulty. The ulcerating syphilids are very frequent in pregnant women, are vivid, purple, and excavated, which condition is increased by the general tumidity of the parts. They persist longer and have a tendency to become phagedenic."

Pregnancy aggravates the general symptoms of syphilis, the anemia is more profound, fever more common and a little higher, digestive troubles are marked, neuralgias, headache, insomnia, and bone pains all exaggerated. Neuralgias beginning shortly after marriage may serve to draw attention to the infection. Tertiary syphilis is less affected by the advent of pregnancy, though sometimes it may mask the disease which was thought to have been cured.

*Effects of Maternal Syphilis on the Pregnancy.*—Luetic women are often sterile, not because the ovarian function is suspended in a manner similar to that of the syphilitic men. There is a syphilitic endometritis which may explain sterility. The actual effects on the pregnancy may vary with the age of the



hilis and the success of the treatment, because if the patient has been successfully treated, she may bear healthy children.

If the syphilis is more recent, the fetus dies and abortion occurs. The subsequent pregnancies terminate the same way, but each one later, until a living but syphilitic fetus is born, and finally a living, apparently well, child at term. This child develops syphilis within a few months or after years (*lues congenita tarda*). This course of events may be interrupted by vigorous treatment of both parents. Healthy syphilitic children are born of apparently sound parents. Engman suggests that in such cases the mother may be a "spirochete carrier," but probably the syphilis will grow apparent later.

Still more rarely apparently healthy children are born of syphilitic mothers. Why the placenta does not allow the virus access to the fetus is not known, nor is the manner of infection of the fetus settled—whether it is primarily ovular or later by perinatal transmission. Spirochetæ have been found in the ova in the ovary of the fetus. Ruge says that 83 per cent. of repeated abortions are due to syphilis. Late abortion—fifth to seventh months—and early premature labor—seventh to eighth months—are characteristic of syphilis. Hydrocephalus, spina bifida, denudations in the nervous system, polydactylia, etc., are often due to syphilis (Léclaux, Rosinski).

If the woman acquires syphilis at the time of conception, early abortion is the rule, unless thorough treatment is given at the start, and even then the child is often stillborn. If the syphilis is contracted during pregnancy, both parents having been well at the time of impregnation, that is, post-conceptional infection, abortion is the rule in the early months, but if the disease was acquired in the latter months, the child may escape, the placenta offering a barrier to the virus. Profeta's law held that a child was immune, but later studies show that these infants have a positive Wassermann reaction (Trinchese). In more than half the cases the fetus acquires the disease through the placenta, even in the last month (Finger), or even during its transit through the birth-canal.

Interruption of gestation is the commonest symptom, and von Winckel found 50 per cent. fetal mortality. It is said that eclampsia is not more common, but the author had four women showing marked albuminuria while carrying syphilitic fetuses. Labor may be influenced by syphilis. The pains may be weak and progress slow. Abnormal presentations are frequent, because the children are usually macerated. A chancre on the cervix may impede delivery, as also may an induration in the secondary stage of lues (Blandin), which may necessitate incisions, craniotomy, even cesarean section. Friability of the perineum was very pronounced in three of my cases, the head bursting through the vulva, tearing it in all directions like wet paper. Condylomata lata vulvæ conduce to such lacerations. Postpartum hemorrhage is usually not greater, but the author had one case of hemophilic atresia in a syphilitic prostitute which made some such relation seem plausible. Ordinarily, if the fetus has been dead long, thrombosis of the placental site occurs.

In the puerperium sepsis is not commoner than usual; the puerperal wounds, unless primarily infected, heal nicely, especially if specific treatment is given. Syphilitic fever may be mistaken for sepsis (Taussig).

*Paternal syphilis* has also a bad effect on gestation, and its action is hard to understand. When the husband has florid primary or secondary syphilis and infects his wife at the time of impregnation, it is impossible to differentiate the results. Abortion is the rule. The history usually given is that the husband has been treated more or less successfully for syphilis before marriage. The limit of safety, that is, the time required before he can procreate healthy offspring, is variously estimated as from two to twelve years, but much depends on the success of the treatment. Even if at the time of coitus he has no infective lesions, the child is usually syphilitic, or it may show signs of the disease later in life. If the father was cured, the child will remain well. If the lues is more recent or uncured, the child dies, macerates,

have shown that syphilis can thus be conveyed (Bab), but it is more likely that the mother becomes syphilitic and the spirochetæ settle in the ovum and decidua and pass into the blood.

A woman carrying a child luetic ex patre, as a rule, becomes immune to syphilis. (See Ham Colles' law, Dublin, 1837.) We know now, from the results of the study of women and infants with the Wassermann blood-test, that the mothers are immune because they are really syphilitic. Colles' law is thus upset, and Wolff's law of 1879 confirmed. A mother carrying an ex patre syphilitic fetus sometimes develops actual lesions which may be secondary and tertiary, or even only primary—the "syphilis by conception." The virus has passed from the fetus through the placental wall to the mother. It is certain that the spirillum of relapsing fever may pass the placenta and infect the child, and, therefore, it is fair to say that the *Spirochæta pallida* may infect the mother by a reverse process.

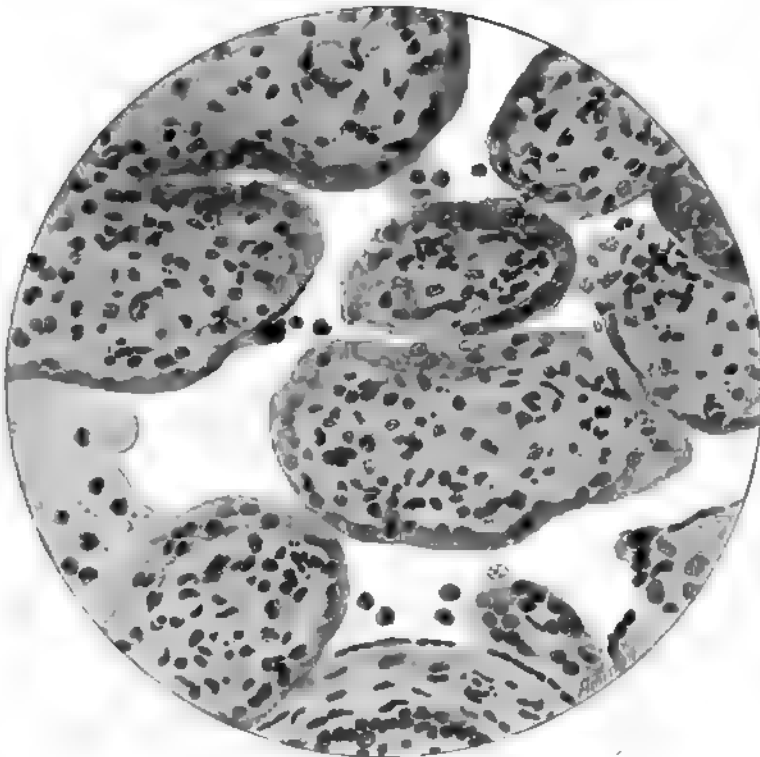


FIG. 431.—SYPHILITIC PLACENTA.  
Compare with Fig. 60, p. 45, normal placenta.

**Syphilitic Changes in the Fetus.**—The skin, the mucous membranes, the viscera, and the bones are most often affected.

**The Skin.**—Bulkous eruptions; desquamation of large areas of epidermis, leaving deep-ulcerated corium underneath; papules and vesicles, especially of the palms, soles, and face; erythema of the buttocks; paronychia; pemphigus; icterus.

**Mucous Membranes.**—Mucous patches in mouth and pharynx, coryza, weeping papules of the anus, fissures and ulcerations of the body orifices.

**Viscera.**—The liver is larger, feels elastic, is granular, and almost always is particularly infected with spirochetæ (Fig. 429) (Levaditi). It shows the antigen reaction. Liver changes explain the frequency of icterus and infection of the child, and also, because its aid in assimilation is lost, the athrepsia of the infant (Bar). The spleen is enlarged, sometimes to five times its normal size. The belly is distended; there is some fluid in the peritoneum. The lungs may show emphysema or a peculiar interstitial infiltration which is characteristic of lues; this is called white pneumonia, and is incompatible with respiration. The kidneys nearly always show an interstitial nephritis and endarteritis and peri-arteritis, with cellular infiltration of the vessel-wall, which is generalized throughout the body, and is also found in the cord (Fig. 430). These blood-changes are pathognomonic. The placenta is large, heavy (sometimes being over one-fourth



FIG. 435a.—SYPHILITIC CHILD—PART OF FACE.



FIG. 435b. SYPHILITIC CHILD—ANAL REGION.

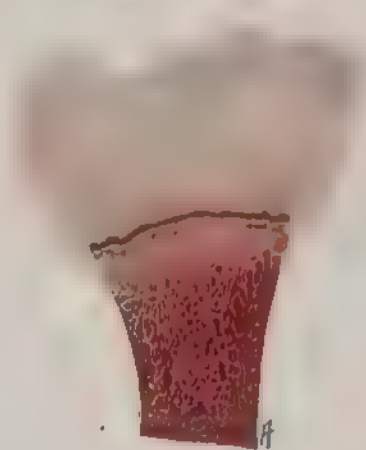
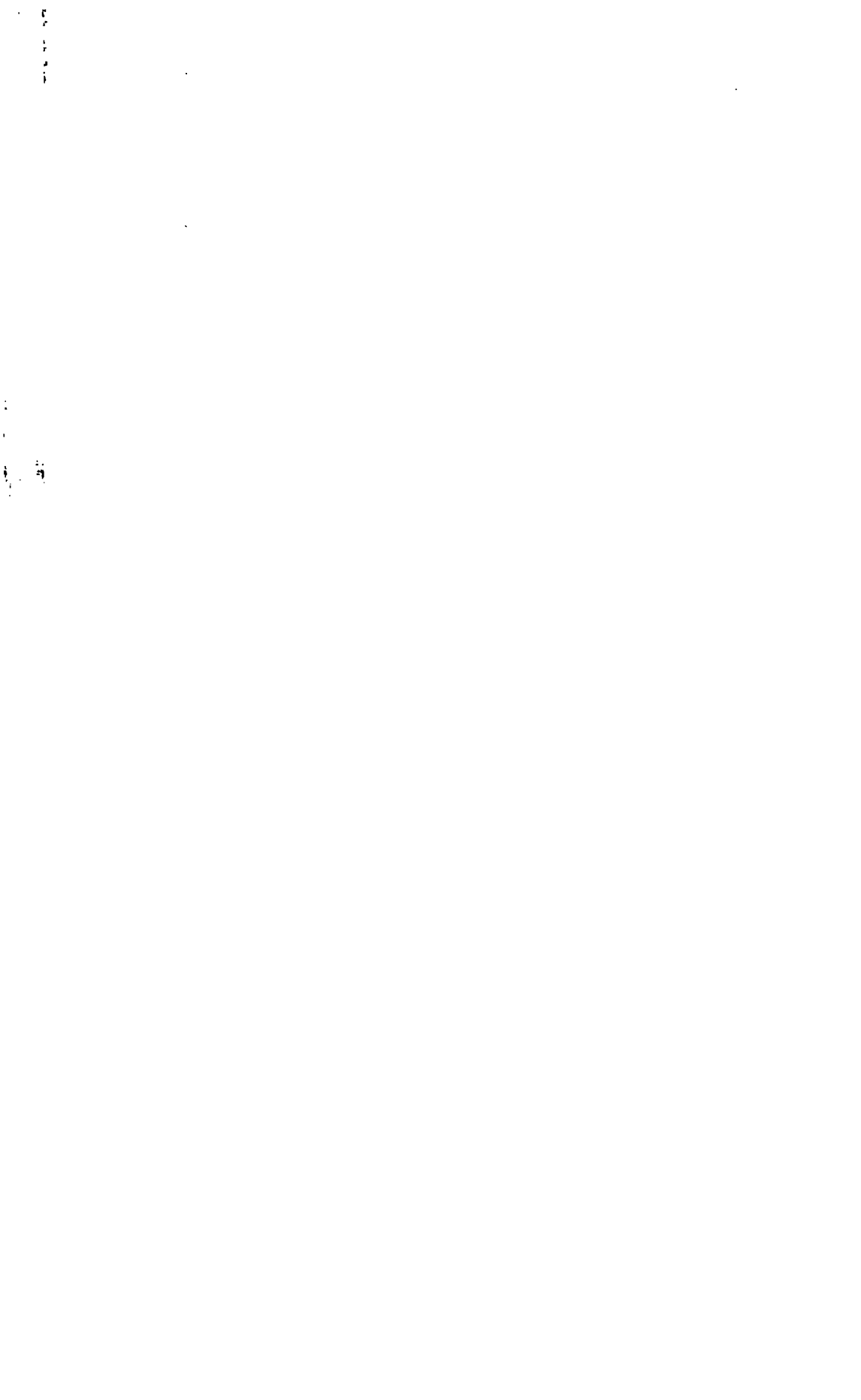


FIG. 435.—OSTEOCHONDRITIS SYPHILITICA (gross specimen from Dr Zeit)



FIG. 435c.—SYPHILITIC CHILD—FOOT.



light of the fetus), pale, soft, fatty, edematous, but these changes are also found in other organs. If the father alone was syphilitic, the changes may be limited to the villi, which are red, club-shaped (Fig. 431), obliterated by overgrowth of white cells, fatty degenerated, areous and sometimes speckled with fine hemorrhages. If the mother alone was syphilitic, changes may be restricted to the endometrium and the purely maternal portion of the placenta. Maternal growths which stretch up between the cotyledons, infiltration of the decidua, and fatty degeneration of the placenta materna, but usually the whole placenta is affected. The arteries, and to a less extent the umbilical vein, are much thickened, even obliterated, a fact which may be used for diagnosis. The spirochetæ are rare in the placenta, but have been found in the cord, liver, spleen, testicle, ovary, skin, eye, etc. The fetal blood shows a mononuclear leucocytosis. The Wassermann reaction is likely to be negative in the fetal blood, even though the mother was luetic (Bar and Daunay), and doubtful reactions may be obtained in the absence of syphilis. From the cerebrospinal fluid the best results are obtained.

**The Bones.**—Osteochondritis syphilitica, described by Wegner (Fig. 435), is the most characteristic and pathognomonic autopsy finding. The line of ossification is broader, with irregular borders and points running into the cartilage. There are small islands of bony matter off to the side of the cartilage, and the whole epiphysis is yellower. In advanced cases the part is swollen and the periosteum thickened. The x-ray shows a line of bony thickening at this point.

The diaphysis breaks off easily. Similar changes occur in congenital rachitis, but a glance at Fig. 435 will enable a differentiation to be made.

Syphilis has been invoked to explain many diseases of the new-born, for example, icterus neonatorum, hemorrhagic diathesis, hydrocephalus, congenital deformities, cystic kidneys, athrepsia, etc. The discovery of the spirocheta and the various serum reactions may bring light in these cases.

**Treatment.**—Syphilis is to be thoroughly treated as soon as discovered, and in the usual manner, regardless of pregnancy. Instituted early, abortion may be prevented. Salvarsan and inunctions seem to give the best results, but since the fetus is vulnerable during pregnancy their action is to be watched. Habitual abortion after the fifth month, or premature labor, when due to syphilis, indicate syphilitic treatment of both parents. In doubtful cases, too, this advice may be given. It is the author's practice to give women with such a history, during pregnancy, mercury, arsenic, and iron as alterative tonics. As soon as it is born the child is also to be treated, and it must be watched minutely for the appearance of skin eruptions, coryza, etc. Salvarsan passes over to the child through the milk, but in small amounts. More important are the specific antibodies developed by the drug, which pass over and are curative. Baginsky warns to care with salvarsan, and advises inunctions (0.5 to 2.0 daily), also baths of 1 : 20,000 HgCl<sub>2</sub>, when there are no profuse eruptions. Isolate the child and use rubber gloves in handling it, since syphilis is very infectious.

**Nursing.**—Only its mother may nurse the infant, because the child is almost invariably diseased, even if it shows no evidences of lues. Latterly cases are being reported in which a luetic mother infected her previously healthy child; but these are rare. The milk of a luetic woman is infectious. If the child is syphilitic and the mother apparently well, only the mother may nurse the infant, because she is entirely luetic. *Never put a child of a syphilitic mother or father to a healthy wet-nurse.* It is criminal, though the law allows only damages from a civil suit. In hospitals and in maternities the authorities must be on guard constantly for this danger. Only after most careful investigation, including the serum reaction, has been made that the baby and the wet-nurse are healthy may nursing be allowed. In hospitals, in maternities, the physicians and nurses should constantly look for the evidences of syphilis.

## DISEASES OF THE CIRCULATORY SYSTEM

**The Heart.**—There is no doubt that the heart regularly suffers an alteration as a result of gestation. It hypertrophies, it dilates, or does both, and Virchow found slight evidences of fatty degeneration.

In the routine examination of the hearts of pregnant women the author, in a majority of the cases, has found systolic murmurs at the base and accentuation of

the second aortic sound, occasionally a presystolic murmur, and displacement of the apex-beat to the left. It was not always easy to eliminate actual vitium cordis. Several real heart diseases were discovered, which, without such a routine examination, would surely have passed through labor without being noticed, because they produced no trouble whatever. Heart disease in labor is certainly often overlooked.

*The Effect of Pregnancy on Heart Disease.*—A normal healthy heart easily satisfies all the extra demands made on it by gestation and labor. Even a diseased heart, if compensation is good, often sustains the additional strain without laboring hard.

*Pregnancy*, therefore, in mild heart cases, in young, otherwise healthy women, does not seem to exert a very harmful influence on the disease, but it has seemed to the author that these women develop discompensation and die sooner than other women, and men with similar cardiac disease. Naturally, it is hard to collect statistics on this point. If the disease is advanced; if the heart is in unstable equilibrium, and especially if myocarditic or fatty degeneration has occurred, the danger of broken compensation with its pernicious sequelæ is present. Pregnancy predisposes to an acute exacerbation of chronic endocarditis, especially if the latter be not too old, and with this sometimes a fatty degeneration of the papillary muscles occurs, which has a bad effect on the compensation. The congestion of the venous system leads to kidney and hepatic disturbances; the pulmonary congestion leads to dyspnea and carbonic-acid narcosis, and the high position of the diaphragm, with the slight decrease of vital capacity, augments the respiratory difficulty and cyanosis. Near term the blood-pressure may rise. Transudations in the pleuræ may cause compression of the lungs, hypostatic pneumonia, and œdema pulmonum, and hemoptysis may also be a complication. Edema of the extremities, ascites, dyspnea, attacks of suffocation, dry cough, palpitation, insomnia, albuminuria—all these show that the compensation is broken and warn the accoucheur of impending danger. Occasionally symptoms of Basedow's appear—tachycardia, sweating, exophthalmos, etc.

*During Labor.*—There is danger from not fully compensated hearts, and, too, an apparently competent heart may suddenly prove default. Without doubt some of the cases of sudden death during labor are due to an unrecognized vitium cordis. I have seen two cases of acute dilatation of an apparently normal heart, but probably unsuspected myocardial disease was present. Even a strong heart may not be able to stand the strain of an unduly prolonged second stage.

Uterine action increases the arterial tension, and straining—bearing down—increases both arterial and venous pressure. The electrocardiograph shows that the heart does more work during labor. In themselves these changes are not very dangerous: it is the fluctuation of the blood-pressure incident to labor which is hard on the heart. Symptoms of a laboring organ appear, or the heart may suddenly give way to the strain, and cyanosis, collapse, œdema pulmonum, and death ensue. If the heart holds out until the baby is born, the balance of the circulation may be established rapidly, or, in not a few cases, sudden death in collapse may occur. In one of the cases seen by the author in consultation the fatal collapse occurred three hours after delivery. The most treacherous cases are mitral stenosis.

*In the puerperium* some of the patients that recover from the strain of labor grow worse, and die from embolism of the brain or lungs, cardiac thrombosis, recurring endocarditis, degeneration of the heart muscle, and aggravation of the existing disease. Sepsis in the puerperium favors acute endocarditis, or may cause exacerbations of an old affection, or may start or increase myocardial degeneration.

Valvular lesions are less affected by gestation than the myocardial diseases, a point which Angus MacDonald, Perry Hart, and others have emphasized. This table is compiled from statistics of Fellner, Porak, and Vinay, and shows the relative frequency of the several affections.

	FELLNER	PORAK	VIMAY
Mitral regurgitation.....	37	22	6
Mitral stenosis.....	5	13	11
Combined mitral disease.....	34	22	7
Aortic regurgitation.....	3	9	1
Aortic stenosis.....	..	2	..
Aortic and mitral disease.....	10	22	3
Myocarditis.....	2	..	..
Unknown.....	3	..	..

A second class of cases is composed of those that develop during pregnancy and the puerperium. It was once thought that a subacute endocarditis is peculiar to pregnancy, but this is not believed any longer. Acute endocarditis may occur during pregnancy. Acute myocarditis and fatty degeneration may occur during gestation, but they are more likely in the puerperium, as evidences of a septic process, though they may occur alone. Brown atrophy has been found in many cases of sepsis. Fatty degeneration of the heart may follow severe hemorrhages, especially if repeated, also prolonged and hard labor, protracted chloroform narcosis, and there has been observed an acute general fatty degeneration similar to Buhl's disease of the new-born. Heart cases are aggravated by the complications of pregnancy, for example, twins, polyhydramnion, contracted pelvis, tuberculosis, toxemia, nephritis, etc.

*Effects of the Heart Disease on Pregnancy.*—Sterility is not common in women with cardiac lesions unless in advanced stages. Profuse menstruation has been noted. Abortion and premature labor, especially the latter, occur in cases of decompensation, in from 20 to 40 per cent., and still-births in 29 to 70 per cent., giving the figures collected from various sources by Fellner. Labor is often slow, the pains not good, and operative interference commoner. It is said that postpartum hemorrhage is frequent, but I have not found it so. Its gravity in heart cases is variously gaged, some authors even considering it beneficial. Placenta marginata is frequent. Heart disease has no particular influence on the puerperal processes. The lochia are somewhat profuse and prolonged, and lactation is imperfect.

*Prognosis.*—Since many women with cardiac disease pass through pregnancy and labor with the condition unknown, it is necessary to receive the published accounts with caution. Published statistics of mortality are, 34, 61, 60, 55, 48, 49, 12, 6, 31, and 85 per cent., and these surely present a dark picture of the gravity of cardiopathy in pregnancy, but Fellner, who collected the above, calls attention to the fact that these are only the bad cases, and that the many mild ones are not reported. He supports the statement with the figures of Schauta's clinic, which showed a mortality of 6.3 per cent., and, if he reckoned in those cases where the vitium was accidentally discovered, it would be only 0.9 per cent. Nevertheless, my own experience has taught me to fear the complication of heart disease with pregnancy, for even though one finally brings the patient through alive, the dangers that threaten at every step are very disquieting, and when accidents occur, they require the promptest and most skilful treatment. Stoeckel, in a 1917 review of German literature, comes to the same conclusions. Mitral stenosis is generally considered the worst of the valvular diseases, so far as pregnancy is concerned, especially when complicated by myodegeneration, which makes all cases very serious. Everything depends on the compensation. Nephritis with high blood-pressure adds much to the gravity of the situation. In uncompensated heart disease many children die from prematurity, abruptio placenta, disease of the placenta, and asphyxia, because of the imperfectly aerated maternal blood and carbonic acid narcosis.

*Treatment.*—A woman with uncompensated heart disease should not marry, and if married, should not conceive, and if she has a baby, should nurse it only in part. If the woman is otherwise healthy, that is, has good lungs, liver, kidneys, etc., and her heart is carrying its burden well, she may marry, and if she much desires it, have children, but the dangers are to be explained to both husband and wife.

Rarely is the physician consulted until pregnancy has occurred. In itself, heart disease is no indication for abortion, yet if a woman with chronic discompensation, with myodegeneration, tuberculosis, kyphoscoliosis, pernicious anemia, struma, with liver or kidney insufficiency, becomes pregnant, it may be necessary to empty the uterus very early, because we know she will not be able to go through the process safely. The earlier the break of compensation occurs, the more dubious the prognosis. If weakness of the lesser circulation is discovered, one may not try to carry the patient through pregnancy. In an old multipara we interfere sooner, too. Expectancy is the rule, but the woman must be under medical surveillance. Patients with heart lesions should take a small amount of outdoor exercise each day, should not overexert nor get excited, should avoid crowds, overeating, and alcohol—in short, should pursue a quiet, normal course of life. On the first signs of discompensation they should rest in bed a few days under restricted fluids and simplified diet. If the heart needs help, digitalis in small doses may be useful. For suffocative attacks morphin hypodermically, digalen intravenously—in short, the usual treatment—is to be given. Should the symptoms aggravate and the heart begin to show its overstrain, labor is to be induced. I am aware that many authors oppose this on the ground that labor is usually the cause of collapse, and that the deaths often occur in the early puerperium, but this reasoning has always seemed to me peculiar. The pregnancy is evidently aggravating the lesion, the heart is proving default, the woman must go through her labor sooner or later, and if she is getting worse in spite of treatment, she will be less and less able to withstand the strain the longer the interference is delayed. The urgency of the symptoms will decide the choice of method. In cases of imminent danger puncture the bag of waters, and as soon as preparations can be made, empty the uterus by vaginal cesarean section or, sometimes, by the abdominal method. If there is no occasion for great hurry, pack the cervix and lower uterine segment with gauze. If no pains are set up, remove in twenty-four hours, puncture the membranes, and put in a small-sized colpeurynter. A woman with heart disease should never be allowed to go beyond term.

*During labor* all heart cases require close scrutiny, even if there is good compensation. Labor must be so conducted that collapse in the third stage and sudden death later in the puerperium are rendered impossible—a task of no small difficulty. Preparations for all eventualities must be made beforehand—plenty of assistants, oxygen, salt solution, venesection instruments, hypodermic syringe with stimulants—in short, the facilities of a well-equipped maternity. All the instruments for operative delivery are to be held, sterilized, ready for instant use. Watch the effect of the pains on the heart, such as cyanosis, flagging, or irregular pulse. Dyspnea between pains is suggestive. Digitalis may be given during labor. When dilatation is complete, puncture the membranes, but let the water escape slowly. As the head comes down on the perineum watch the effect of the bearing-down efforts on the heart. Even if the dyspnea is not very marked nor the cyanosis very deep; if cough sets in; if the pulse begins to drop beats; if it gets very rapid—108 to 130; if the bearing-down efforts do not produce regular and decided advancement of the child, extract at once. Do not wait for actual edema of the lungs or actual cardiac failure to spur you to action, because in such cases, even if you do save the patient, the time that the circulation has been in abeyance has perhaps allowed a clot to form in the heart, or the overstrain of the muscle has caused a hemorrhage in the myocardium, and, later in the puerperium, death may occur from embolism or cardiac rupture. Pituitrin is to be avoided. Extraction is done by forceps or by the breech, depending on conditions, but the actual delivery is to be executed slowly, and two strong hands must follow down the uterus, so that the intra-abdominal pressure is not reduced too quickly, since the rush of blood into the dilated veins of the abdomen would tend to leave the enlarged heart empty. Some authors recommend that the woman be allowed to bleed freely in the third stage. I do not believe it is wise.



and permit it only in cases of mitral stenosis, and where the pulmonary circulation is evidently overloaded. Delivery of the placenta should not be hastened. Ergot may, if necessary, be given after the third stage. Ether is the anesthetic of choice, professional anesthetizer being employed, if possible, since this will enable the accoucheur to give all his attention to the delivery of the child. In myodegeneration of the heart it is best to give no anesthetic, and I have been surprised to see how much could be accomplished by encouragement and suggestion. In many cases local anesthesia with novocain is usable.

Should collapse occur at any time during the first stage, it must be combated instantly, for reasons above given, and labor should be completed by bimanual dilatation, cervical incisions, or even the vaginal cesarean section. When the fetus is dead, craniotomy is to be done. While doing these, or after delivery, give hypodermically 30 minims of camphorated oil, then 30 minims of tincture of digitalis (or 5 c.c. of digalen intravenously), oxygen by inhalation, and 6 ounces of strong black coffee per rectum. A very tight abdominal binder is applied, or a sand-bag laid on the belly. For œdema pulmonum the same treatment is given. Venesection may be useful when the heart is overengorged, 8 to 12 ounces being withdrawn. Though used in other heart cases, I have never found it necessary under these circumstances. Salt solution is not to be given in these cases unless complicated by severe hemorrhage. Since the most critical period is just after delivery, a physician should remain near the patient for at least twelve hours. In the puerperium absolute rest, with the body horizontal, the head a little raised, and the exhibition of the usual remedies, are advised. Nursing is to be prohibited only in bad cases, and always one should prevent too great a drain on the woman's resources.

**Basedow's Disease.**—Palpitation of the heart is not infrequent during gestation, caused by indigestion, toxemia, exercise, or by a pure neurosis. I have seen not a few cases where, during pregnancy, tachycardia, nervousness, struma, and slight exophthalmos have raised strong suspicions of Basedow's disease, but the symptoms disappeared later. These may be toxemic in nature. Indeed, many cases of true Graves' disease show symptoms which we find in the pregnancy toxemias. On the other hand, clinically typical Graves' disease occurs during gestation, and perhaps more frequently than the literature would indicate. It seems to me the author that pregnancy brings out the latent affection, but rarely causes serious aggravation of the symptoms unless toxemic conditions are added as a complication. Sometimes pregnancy ameliorates the symptoms, the fetus taking up the excess of thyroid secretion. Repeated pregnancies usually have a bad effect. Hirst had a patient in whom the disease recurred in three successive pregnancies. Labor does not produce serious trouble, except in the advanced cases, and then the conditions are the same, and one treats them the same as heart lesions. The puerperium exerts no special influence, though sometimes the course of the disease continues downward during this time.

Amenorrhea and sterility are common in women suffering from exophthalmic goiter, because of the atrophy of the uterus and ovaries. Pregnancy, however, has occurred during the amenorrhea. Abortion is not usual unless the cardiac decompensation is marked. In bad cases death of fetus and premature labor may occur. Labor is uninfluenced by the disease, but it is said that abruptio placentæ and postpartum hemorrhage are more frequent (White). Hyperinvolution is common. Lactation is likely to be imperfect, and only few cases show oversupply of milk. The fetus is usually healthy. Thyroid secretion passes over to the child in the milk. Graves' disease is exceedingly rare in infants, only one case at four weeks being on record.

The treatment of the disease is the same as if the woman were not pregnant, and, in general, what was said of the care of heart cases in pregnancy applies here. Abortion may be required if the heart proves default early, and especially if toxemic symptoms predominate, though perhaps ligation of the upper poles of the gland, or

hy.) Jaundice may be observed after delivery when general anesthesia has been used, especially after chloroform. One should think of late chloroform-poisoning, that is, liver autolysis. The child delivered from a jaundiced mother is not icteric.

**Gall-stones.**—Ninety-eight per cent. of women operated for gall-stones have borne children. It seems that pregnancy is a factor in the development of gall-stones, and it is not rare that the gravida has attacks of biliary colic. This is due to interference with the free circulation of the bile, thickening of the same, from passive hyperemia of the liver, increased destruction of the red blood-corpuscles, and the products of fetal metabolism, but infection and trauma are the exciting causes of the formation of stones. The colics seldom occur before the fifth month, and jaundice, with chills and fever, is more common than in the non-pregnant state. Labor may cause pain in the full gall-bladder, and the latter may be easily palpated during the third stage. In the puerperium attacks of gall-stones are infrequent. I have observed five cases, in one of which the symptoms were very stormy, with intense pain, collapse, and vomiting, so that suspicion of the rupture of an abdominal viscus could well be entertained. Operation should be postponed, if possible, until after delivery, at least as late in pregnancy as possible, because premature labor may occur and the child be lost. However, the later operation is made technically difficult by the large uterine tumor. Only that operation should be done which will quickest remove dangerous conditions (Peterson). Prochownick says that attacks of pancreatitis may simulate gall-stone colic.

Bar has called attention to a syndrome of pain in the region of the gall-bladder, the ureters, and the appendix, with occasional fever, the pathologic basis being a cholecystitis, ureteritis, and appendicitis. He calls it "*coli bacillose gravidique*." This is a not rare condition in pregnancy. Bacteriuria accompanies it.

Acute cholecystitis may complicate pregnancy, labor (rupture), and the puerperium. The symptoms are quite stormy and jaundice common. It is better to wait until after delivery for the operation, if possible, but in the presence of a strict indication, for example, a large empyema, one may have to drain the sac before labor. In one case the author had to make a differential diagnosis between puerperal infection and pus in the gall-bladder (*cf.* Vineberg). Absence of local evidences of puerperal disease, signs of local peritonitis in the upper abdomen, with appropriate history, usually indicate the exact source of the trouble.

**Appendicitis.**—Many pregnant women complain of pain in the region of the appendix, and it is possible that the rising uterus draws on complicating peritoneal adhesions. Women who have had appendix operations almost always complain of dragging pains, especially from the fifth to the eighth months. Primary appendicitis is very rare, but recurrent disease is not rare during gestation, the latter being usually the catarrhal variety, and seldom causing real trouble. Pels Leusden found decidua reaction in the pregnant woman's appendix. This may explain the frequency of appendiceal attacks in pregnancy.

Perforation and suppurative peritonitis are very much more serious than outside of pregnancy, because—(1) Protective adhesions are less likely to be formed, the omentum and gut being pushed away by the enlarging uterus; (2) the inflammation is more stormy, owing to the intense vascularity of the parts; (3) thrombosis and phlebitis are commoner; (4) suppuration takes place higher in the abdomen (true of late pregnancy), which portion is recognized to be less resistant; (5) drainage is less free, owing to the large uterus near by, and the abscesses burrow deeply in all directions; (6) tympany compromises the respiration sooner, also pneumonia and pleurisy; (7) obstructive symptoms arise earlier; and (8) the bacteria floating in the blood may accumulate in the placenta, and even the fetus, causing abortion and sepsis. The mortality, according to Schmid, who collected 486 cases, is very high. Appendicitis offers a better outlook the earlier in pregnancy it occurs and the sooner it is recognized. During labor the contracting uterus may rupture the pus-sac or

tear an adherent or perforating appendix, with resulting general peritonitis, which may be mistaken for sepsis sub partu. This danger is greatest during the third stage and during the first few days of the puerperium, at which times the uterine fundus makes its greatest excursions. In the puerperium acute appendicitis is easily mistaken for an infection of the tubes or broad ligament, and, indeed, they may coexist. The puerperal processes aggravate the appendiceal disease.

The effects of perforative appendicitis on the pregnancy are also marked, abortion, premature labor, infection of the uterine contents, and death of the new-born child being noted in the majority of cases. This might all be forestalled by early operative removal of the infective focus. Labor is very painful; the shock of it is greater, and because of the diseased uterine muscle (contiguous to an abscess) weak pains in all three stages are observed. Manual removal of the placenta is more often needed, and such brusque manipulations spread the pus. On the puerperium the worst influence is shown when the diseased appendix forms adhesions to the tube or the uterus, direct transmission of the infection being thus effected, either through the walls of the applied organs or along the surface—also through the blood. A parametritis may also be caused by the infection creeping through Clado's ligament. The relics of appendicitis may anchor the uterus in an unfavorable position, may occlude the tube, producing sterility or favoring ectopic gestation. On the other hand, I am convinced that tubal infections cause appendicitis. The frequency of appendicitis in newly married women is striking, and the gonococcus was found by J. H. Hess in the pus from an appendix.

The diagnosis of appendicitis should present no special difficulties if only the possibility of its occurrence be kept in mind. Ectopic gestation (*q. v.*) and twisted ovarian tumor come up for consideration, but most mistakes are made with ureteritis and ureteral stone (*q. v.*). All possible causes of acute peritonitis must be discussed—gastric ulcer, cholecystitis, etc. In the puerperium sepsis must always be thought of, and only a laparotomy may explain the equivocal symptoms. A worse prognosis than usual is to be made because nearly 40 per cent. of perforated appendix peritonitis cases die.

*Treatment.*—Recurrent appendicitis should be cured before pregnancy occurs. A woman with only a history of appendicitis should not be operated during pregnancy unless a recurrence takes place. Appendicitis in pregnancy should always indicate immediate operation—even in cases of doubt, operation is the safer course. After spontaneous recovery from an acute attack during pregnancy the appendix had better be removed as soon as possible. The incision is made higher than ordinarily, the appendix preferably removed, and in pus cases drainage should be liberal. The uterus is manipulated as little as possible, and the rule "get in and get out quickly" is observed. Every effort should be made to prevent premature labor. Should abortion occur, it should be allowed to run as natural a course as possible, the tampon and even prolonged expectancy being employed. Manual curetage is to be replaced by instrumental should the uterus not empty itself. The reason for this is evident—the outside hand may break the protective adhesions around the abscess. During labor the same rule applies, and if manual removal of the placenta is necessary, the dangers of spreading the abdominal infection should be borne in mind. No doubt, too, genital infection is favored by all intra-uterine manipulations. If abortion is impending at the time of operation, the uterus should first be emptied, and then drainage of the abdomen carried out. The question of emptying the uterus artificially before operating on the appendix has been raised; even cesarean section has been proposed if the woman is near term. Early in pregnancy one will usually not induce abortion, but trust to drainage and nature. When one considers the high mortality of suppurative peritonitis at or near term, perhaps it would be best, in the interests of the two individuals, to remove the appendix and do a Porro cesarean section at the same time. Not enough cases are on record to definitely settle this point. I believe, in cases where the uterus is opened in the presence of pelvic infection, as from ruptured appendix, pus-tube, or infected tumors, it is best to amputate the bulky organ and drain the whole pelvis freely from below. If the operation removed an acutely inflamed appendix without adhesions or abscess, it is not advisable to empty the uterus from below at once, because pregnancy may go on without further trouble, and if a walled-off abscess has formed, it is dangerous to do so, because during labor the adhesions always break. With free drainage and the use of opium one may tide the woman along for several days and thus allow the sac to get firm and the amount of pus in it to be reduced. Obstetric interference may thus be delayed until the abscess cavity is granulating safely. Krönig advises in abscessed cases first drainage, then vaginal cesarean section, then inspection of the abscess cavity for breaks, which are closed by fine sutures. (See also Hilton, Rudaux, Heineck, Abrahams, Murphy, McArthur.)

**Ileus**, a rare complication, may be due to the same causes which produce it outside of pregnancy, or may be due to compression or torsion of the gut by the growing uterus. Naturally, the gut must be abnormally adherent for this to take place. In one of the author's cases an old appendicitis was responsible for the adhesions, and the uterus at term dragged on the intestine, producing severe pain in the right iliac fossa and almost complete obstruction—induction of labor, recovery. If the ileus is due to a complicating suppurative peritonitis, premature labor is the rule and death very common (Gauchery). Treatment is the same as in surgical practice, except in those cases, as the one mentioned, where it is reasonable to believe that the growing uterus is the acting cause of the obstruction; then, if the child is viable, the uterus is to be emptied; otherwise separation of adhesions via laparotomy. Ileus after delivery may be due to the trauma of labor (intestinal paresis), obstruction of the bowel by the large uterus incarcerated in the pelvis, to duodenojejunal closure, and to peritonitis.

**Hernia** is not seldom met by the accoucheur. Unless the gut is adherent, the growing uterus pushes the contents of the sac out and away from the hernial opening, and makes a temporary cure, but the ring is enlarged by the distraction of its walls, and the hernia is worse in the puerperium, though incarceration is rare. An adherent gut may be incarcerated, twisted, or stretched even to the production of abscess. During labor the opening is usually closed by the large uterus, and even during strong bearing-down efforts the rupture does not enlarge. I saw, however, an inguinal hernia develop during strong expulsive effort. Treatment of hernia is the same as at any other time when threatening symptoms occur. During labor it is not wise to allow too strong effort if one sees the hernial tumor enlarging. Forceps should be applied soon after the dilatation is complete. It is not safe to hold the gut back during the strong expulsive straining. Umbilical and post-operative hernias are usually permanently enlarged by pregnancy, and traction on adherent omentum often causes pain (Manley).

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## CHAPTER XXXIX

### DISEASES OF THE URINARY SYSTEM

**Nephritis.**—Internists distinguish the following principal forms of renal disease: Acute nephritis, chronic nephritis, of which there are two grand divisions, the parenchymatous, with its three forms, large white kidney, large red kidney, and the secondary contracted kidney; and the chronic interstitial or primary contracted kidney, which is accompanied by cardiac hypertrophy and a general arteriosclerosis. The accoucheur, in addition to these, must consider the kidney of pregnancy, its aggravated form, the so-called pregnancy nephritis, and the kidney changes which are part of eclampsia. Since even the internists are not in perfect accord regarding the classification of their physical findings and admit that the various recognized varieties of disease may be associated or correlated, it is not to be expected that the accoucheur will be able absolutely to identify the many conditions presented to him for treatment. The symptoms of watery transudations in the parenchymatous forms give them the appellation "wet"; the interstitial varieties are "dry."

The kidney of pregnancy and the kidney in eclampsia have already been considered in the chapters devoted to Incidental Diseases. Here will be discussed the accidental complication of pregnancy with renal disease. Although only one-quarter to one-fifth of nephritics develop convulsions—perhaps eclampsia—in pregnancy, the association of the two conditions is always fraught with grave dangers to mother and child.

*Primary acute nephritis* may develop during gestation from the same causes which operate outside of it, for example, exposure to cold, chemical poisons, ptomainemia, scarlatina, angina, and infections of various kinds. Antecedent septic processes make the kidney more vulnerable, which tendency is aggravated by pregnancy. Acute nephritis cannot be clinically differentiated from the "pregnancy nephritis" which often leads up to eclampsia, and, therefore, will not be further discussed here. (See Eclampsia.)

*Chronic parenchymatous nephritis* is always unfavorably affected by the advent of gestation, and an acute exacerbation is almost always observed. It begins to show in the early months, contrary to the renal disease incidental to pregnancy. Puffiness of the eyelids and of the ocular conjunctiva and general anasarca are marked and do not disappear in the recumbent position. The edema affects the legs, which may be elephantiasic, and the vulva, which may be transformed into two immense, white, translucent, watery, glistening tumors. Hydroperitoneum, hydropleura, œdema pulmonum may occur; pallor, a waxy, pasty skin, high pulse tension, even in this form, are to be noted. Headache, neuralgias, epigastric pain, disorders of the special senses, especially amaurosis, nausea, and vomiting, are found, but not so marked nor so common as in preëclamptic toxemia. Retinitis albuminurica is very serious, and may leave permanent blindness. Convulsions occur, but in less than one-third of the cases. The urinary findings are similar to those of preëclamptic toxemic nephritis—albumin, hyaline, granular, cellular casts, renal epithelium, white and, finally, red blood-corpuscles. Urea is diminished, the total solids reduced, the daily amount of urine much less than normal.

Labor has a noxious influence on the nephritis, and often produces alarming

symptoms—œdema pulmonum, collapse, which may simulate pulmonary or cerebral embolism, apoplexy, and suppression of urine. Anemia is badly borne by nephritics. If anesthetics are given, and if the labor is protracted and exhausting, real damage may be done to the kidneys.

The puerperal processes do not exert a good influence either—sepsis is common and nephritics do not bear infection well. While the urine usually rapidly clears up after delivery, the restitution of the kidneys is never complete, permanent structural damage having been wrought, and the action of repeated pregnancies is bad that death is hastened.

*Chronic interstitial nephritis* is more frequent than the parenchymatous, and is characterized by polyuria of low specific gravity, with little urea and small amount albumin, few casts, and these usually of the hyaline variety. It is accompanied high arterial tension (200 to 240 mm.), thickening of the vessels, and hypertrophy of the heart. The effects of this form usually appear later in the pregnancy, the symptoms of urinemia already mentioned occur with almost equal frequency, and especially in the later months, the distinctions between the various forms become blurred. Retinitis, apoplexy, and heart collapse are more frequent in cirrhotic kidney, and convulsions less frequent.

All forms of nephritis have a very bad influence on the pregnancy, abortion and premature labor being common (66 per cent., Hofmeier); Seitz found that only from 20 to 30 per cent. of the children survived. One of the causes of habitual death of the fetus and abortion and premature labor is chronic nephritis. Labor in nephritics is slow: the uterus is indolent; the edema of the vulva predisposes to ineffectual lacerations, and in one case of the author's the edema of the pelvic structures prevented the head from engaging in the pelvis. Even after the delivery, which was very laborious, the cervix could not be drawn down to the vulva as usual, because it was anchored up high by the infiltrated broad ligaments. Abruptio placentæ is not infrequent. Postpartum hemorrhage is common because of atony of the uterus. Involution is slower. Many of the children are born dead and more or less macerated. The death of the fetus is caused by—(1) The hemorrhages, the white infarcts, and the sclerosis of the blood-vessels of the placenta, which cut off the fetal circulation and are frequently found (80 per cent.). Simpson and Hirling called attention to these facts, and the French call the condition "placenta albuminurique" (Fig. 488). (2) By the frequent abruption of the placenta in labor. (3) By the accumulation of toxins in the blood which alter the villi, making them unfit for the function of nourishing the child, or toxins lodge in the decidua, making their blood-vessels brittle and thrombotic, and the decidua liable to separation (a degenerative endometritis); in the first instance death of the fetus occurs; in the latter, hemorrhages into and separation of the decidua with abortion result. (4) The fetus is poisoned by the toxins which pass over from the mother. (5) Eclampsia may interrupt the pregnancy.

The children of nephritics are usually puny and pale; they thrive poorly at birth, and may show albuminuria with casts. Infarcts and hemorrhages may so reduce the functioning area of the placenta that the fetus does not receive enough food—it starves in utero. The placenta may be edematous rarely, the fetus also.

*Diagnosis.*—The discovery of albumin in the urine at one of the routine examinations leads at once to a minute investigation of the cause. It is an error of art to be surprised into making a urinalysis by the symptoms of nephritis. The author is very skeptical about the so-called physiologic albuminurias—most often a slumbering disease is at the bottom. Before deciding that the kidneys are affected one must eliminate cystitis, ureteritis, and congestive conditions. It is usually impossible to differentiate the various forms of nephritis during gestation, because the anatomic and clinical pictures are blurred, but it is not essential for treatment. A prognosis of the functional capacity of the kidneys is of more importance.

surgeons. Bacteriuria is found in a large per cent. of healthy pregnant women. The ureters, particularly the right, have been found dilated and filled with urine in about two-thirds of the gravidæ coming to autopsy. This is caused by torsion, stretching, or kinking of the ureters, due to the enlargement and dislocation of the pelvic organs, but not to compression, since the specific gravity of the pregnant uterus is about equal to that of the intestinal mass. The pressure in the pelvis of the kidney is only 10 mm. Hg, so that slight causes may stop the flow of the urine in the ureter. Owing to the stasis of the urine and the bacteriuria, a pyelo-ureteritis is easily set up, but infection can reach the parts also through the blood from a gastro-enteritis, an angina, polyarthritides, or thrombophlebitis, through the lymph-stream from contiguous structures, for example, the appendix, the colon, and by ascending from the bladder either on the mucosa or in the peri-ureteral lymph-vessels (Sweet). The bacterium most often found is the colon bacillus, but the streptococcus, the staphylococcus, the *Proteus vulgaris*, pneumococcus, *Bacillus typhosus*, *B. paratyphosus* (Williamson), and, frequently, according to Vineberg, the gonococcus, may be associated, or even the actual cause. Pregnancy may develop the disease, or may aggravate a preëxistent inflammation which may have started in childhood or at the defloration (Wildbolz). Two varieties are found in practice—the acute and the subacute.

In the acute cases there are chill, fever, of pyemic type, sometimes vomiting, pain in the back and along the ureter, and the symptoms of cystitis—dysuria, frequent urination, vesical tenesmus, etc. Rarely all symptoms are absent, the disease being accidentally discovered by urinalysis. On palpation the kidney is sometimes enlarged and always tender; on vaginal examination the base of the bladder is sensitive, the ureter usually easily palpable, thickened, and acutely painful to touch. At first there may be suppression, but soon the urine is increased in amount, is cloudy, contains at first little, later much, pus, albumin, characteristic epithelium, and swarms with bacteria. If the kidney structure itself is involved—and these cases are usually mixed streptococcus and *Bacterium coli* infections—the general symptoms take on a septic nature, such as repeated chills, with irregular high fever, rapid pulse, sweats, and evidences of severe illness, while locally a pyonephrosis may develop. One or both ureters may be involved, but the disease is thrice more frequently right-sided. Stone in the kidney or ureter gives the same symptoms as occur outside of pregnancy.

Suppression of urine in the course of ureteropyelitis may be either renal or ureteral, in the former case due to inflammatory congestion, in the latter to blocking of the ureter. The diagnosis of blocking of the ureter is not easy. Renal colic, intermittent polyuria with discharges of pus and relief of pain, the results of catheterization of the ureters, access of fever at the time pus is absent from the urine,—all are suggestive. The phenolsulphophthalein test is more useful in these surgical renal affections than in nephritis.

When the infection is subacute, the symptoms are milder; frequent urination and evidences of cystitis may exist for several weeks before the pain in the ureter and the kidney shows the ascending involvement of the latter. In both cases the tendency is toward cure, requiring two to eight weeks, and recovery may be complete during pregnancy or almost certainly after delivery. Recurrences are infrequent. One observes the affection most frequently about the fifth month and again near term. Renal calculi may be an additional complication. In the puerperium acute pyelitis also occurs, and may give rise to suspicion of puerperal infection, and it is possible that the infected urine flowing over the genital wounds may cause sepsis. A pyeloureteritis which apparently healed during pregnancy may light up in the puerperium.

*Diagnosis.*—On the direct, the symptoms enumerated plus the urine findings will usually suffice. I have frequently noted the presence in the urine of swollen

and transparent mononuclear leukocytes, the nucleus hanging on the side of the clear protoplasm. A fresh catheterized specimen is to be centrifuged for the minute microscopic examination. On direct palpation of the kidney region tenderness may be elicited by gentle succussion with the fist earlier than by pressure (Israel). In the differential diagnosis appendicitis, calculi, and puerperal infection are to be considered.

#### PYELO-URETERITIS AND STONE

1. Pain goes from the kidney down ureter.
2. Vomiting rare—commoner with stone.
3. Tenderness in lumbar region and in the course of the ureter.
4. Abdominal rigidity not pronounced.
5. Fever irregular and usually not high, unless sepsis present.
6. Pulse slow, and even if rapid, not peritonitic.
7. No tympany nor tumor.
8. Urination frequent and often tenesmus.
9. Urinalysis—pus, always bacteria, sometimes blood, tailed epithelium, and findings of desquamative catarrh.
10. Cystoscope shows ureteral openings, swollen and inflamed, with pus issuing, and often cystitis or perhaps a stone may be seen. If the bladder is normal, ureteral catheterisation will show the cloudy, bacteria-laden urine.
11. May feel thickened, tender ureter (Fig. 436).
12. Succussion pain in right loin.

#### APPENDICITIS

1. Pain radiates toward navel.
2. Vomiting the rule.
3. Tenderness over McBurney's point and lower abdomen.
4. Rigidity usually marked.
5. Fever more constant and continuous.
6. Pulse high, like peritonitis.
7. Both often.
8. Rarely observed.
9. Perhaps a little albumin.
10. Negative.
11. Negative.
12. Absent.

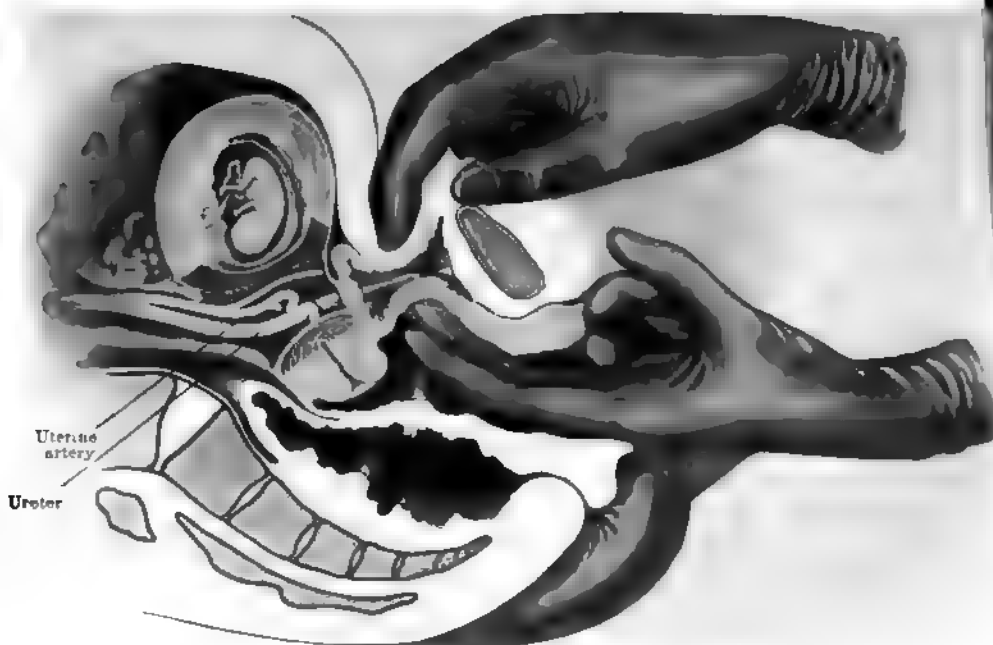


FIG. 436.—PALPATING LEFT URETER.

**Treatment.**—Acute cases. Rest in bed, milk, buttermilk, and water diet; hexamethylenamine, 8 grains, with methylene-blue, 1 grain, four times daily until the acute symptoms have subsided, then bland diet, with little meat. The urine must be rendered acid. Occasionally the patient improves if the urine is made alkaline for a few days, then acid again. If the urotropin should cause hematuria or disturb the stomach, salol may be substituted. For the subacute cases the same treatment for a few days, then more freedom and food. The knee-chest position, assumed thrice daily, for ten minutes each time, and the elevated Sims' posture (Fig. 557) while in bed, are strong adjuvants, often actually curative. To aid posture in relieving the stagnation of the



urine a balloon pessary may be placed in the vagina to lift the uterus out of the pelvis, and warm vaginal douches may be given. Water is to be freely administered by mouth, per rectum, and hypodermically. Ureteral catheterization, washing out the pelvis of the kidney, with or without the instillation of antiseptics, has been so successful that it should be given a trial before radical measures are instituted. Israel, Rovsing, and others do not fully approve of ureteral catheterization. Vaccine therapy had better be postponed until after delivery unless the disease proves rebellious. The results are dubious.

It is almost never necessary to incise the kidneys (pyonephrosis), and rarely needful to induce labor. In very bad cases the latter may be done because recovery ensues when the uterus is emptied. In operating the infected urine should not be allowed to soil the field. Deaver and the author did abdominal cesarean section in order to surely avoid this danger. A stone in the ureteral opening may sometimes be seen and extracted cystoscopically, and such an examination should always precede any operative interference. Pus in and around the kidney is to be treated on surgical principles. (See Venus, Burnett, Kolischer, Opitz, Cumston.)

**Bacteriuria.**—In 1895 the author found a pure culture of *Streptococcus pyogenes longus* in the urine of an apparently healthy gravida of the ninth month. This woman had an operative delivery, and developed double phlegmasia alba dolens on the tenth day of the puerperium. Another patient suffering from sepsis in 1896 showed enormous masses of a streptodiplococcus in the urine and in the ochia. Petruschki in 1898 first showed that living typhoid bacilli could be found in the urine months after convalescence. Weichselbaum (cited by Walthard, *oc. cit.*) showed the streptococcus in the urine in a case of sepsis.

Ahlberg found bacteriuria in 15 per cent. of pregnant women. Murray found the *Bacterium coli* in the urine in 44.5 per cent. of gynecologic cases before, and in 93 per cent. after, operation. Weibel found the urine sterile in only 25 per cent. of cases, proving present streptococci, staphylococci, and colon bacilli. It would be interesting to discover what percentage of eclamptics and nephritics show bacteria in the urine. Without doubt the healthy kidney can and does excrete bacteria, and it is more than probable that it may suffer injury in its task. I have long believed that some of the albuminurias we meet in pregnant women are due to urinary infection, and this may explain the septic mortality of operations on such patients. Cloudiness of the urine is often due to bacteria, and it is the author's practice to give such cases hexamethylenamin or salol until the condition is bettered. It is not unlikely that many instances of puerperal infection will be traceable to infected urine. During obstetric operations one should not allow the urine to drip over the field, and if it does, the parts should be washed with antiseptic solutions.

**Cystitis** occurs as the result of retroflexio uteri gravidi, but it may appear alone, from the usual causes, aggravated by the vascularity of gestation. Mild cystitis of the trigonum is common and induces frequent urination. Diagnosis and treatment are on general principles.

Hemorrhage into the bladder from vesical varicosities, hematuria from other causes—*e. g.*, tuberculous kidney, acute hemorrhagic nephritis, stone, pyelitis, ulcer, pilloma vesicæ, etc.—are observed rarely. The essential hematuria of pregnancy may be toxicemic, and may respond to hypodermic injections of Ringer's solution, normal horse-serum, or that of a healthy gravida. A careful cystoscopic examination, perhaps with ureteral catheterization and a bacteriologic study of the urine, are necessary to make a diagnosis.

## CHAPTER XL

### DISEASES OF METABOLISM—DISEASES OF THE EYE, EAR, NOSE, AND THROAT

#### DISEASES OF METABOLISM

**Diabetes.**—Sugar in minute traces is found in the urine in about 45 per cent. of gravidæ, but it is almost always milk-sugar or lactose, and when proved such, requires no further attention. True glycosuria is very rare, unless the minute traces which are discoverable with fine reagents are considered, and when it is found, is always of serious moment. Alimentary glycosuria is more easily produced in pregnancy than in the normal state, a point which must be considered in evaluating the discovery of mellituria. Hyperfunction of the hypophysis, the thyroid, *et al.* may cause temporary glycosuria. Transient glycosuria, sometimes to the amount of 2 or even 3 per cent., may occur in the latter weeks of gestation (Blot, 1856), accompanied by mild symptoms of diabetes. Many hold these cases as of no real significance, since recovery takes place after delivery, but the author believes that they are really the first warnings of underlying disease, and that the after-history of the women will show the same. Habitual death of the child in pregnancy and after labor is sometimes found in such women, and in two of my cases a clear hereditary tendency was proved. Kidney diabetes occurs in pregnancy. Novak reports 5 cases. The health of the patient is not affected, the amount of sugar is uninfluenced by diet, and the sugar-content of the blood is not augmented. Acetonuria is absent. Sugar, therefore, may be found in the urine as the result of (1) true diabetes mellitus, which is rare; (2) lessened sugar tolerance of pregnancy; (3) hepatic inefficiency; (4) permeability of the kidney; (5) disturbance of the endocrine system; (6) hyperfunction of the breasts (lactosuria).

*Effects of Diabetes on Pregnancy.*—Sterility is common, Lecorchè, of 114 cases, finding only 7 gestations. This is due to atrophy of the uterus and ovaries, which also explains the frequent amenorrhea and premature menopause. Abortion and premature labor occur in 33 per cent. of the pregnancies, the fetuses usually being macerated. The children, if the pregnancy goes to term, often die shortly after birth, the total mortality being 66 per cent. Sugar is sometimes found in the liquor amnii, and if germs gain access to it during labor (*Bacterium coli*), decomposition sets in and gas forms—physometra. The infant may have glycosuria. Polyhydramnion is frequent, and overgrowth of the child, perhaps edema, has rarely been noted. Labor in diabetics is not very different from the normal unless complicated by the large edematous fetus or polyhydramnion. Hemorrhage is not a prominent symptom, nor does the puerperium show anything unusual. Sepsis is not more frequent—indeed, it seems as if there is a little more resistance to infection.

*Effects of the Pregnancy on the Diabetes.*—Without doubt pregnancy has a bad effect on the course of the disease. It may develop a latent diabetes, there being cases where severe symptoms appeared only during successive pregnancies, and others where the disease grew progressively worse each time. Since the carbohydrate control of the liver and pancreas is at fault in diabetes, and the liver is overburdened during gestation, functional overstrain is easily explained. Unless treatment is instituted the sugar in the urine increases, the malnutrition becomes marked, and the nervous system, which, as usual in pregnancy, suffers first from bad influences, begins to show signs of intoxication. Coma occurs in 30 per cent. of the cases and is almost always fatal. It may be brought on by a very slight shock in

pregnancy, but more often during and just after labor. Delivery seems to have even a worse effect than most surgical operations, causing collapse, coma, or sudden death. Bronchitis has been often noted in the puerperium, and this has been often found to be tuberculous.

*Diagnosis* consists in determining whether the case is one of true diabetes, lactosuria, renal or alimentary glycosuria, or transient glycosuria (always to be viewed with suspicion). A true diabetes will be diagnosed when the classic symptoms are present—grape-sugar in the urine, polyuria, thirst, hyperglycemia, and malnutrition, and especially if the urine shows large amounts of sugar, acetone, diacetic and beta-oxybutyric acids. Alimentary glycosuria will be cured or at least improved by proper diet, and kidney glycosuria will show normal blood-sugar.

*Prognosis.*—True diabetes has a very bad prognosis, Offergeld finding over 50 per cent. mortality, of which 30 per cent. died in coma, the others of tuberculosis or coma, within two and one-half years. Today with proper treatment the mortality is much lower, and Joslin reports many cases where even pregnancy was carried through to term. Albuminuria is an ominous complication. Of the children, 51 per cent. were stillborn, and even though apparently well at birth, 10 per cent. died within a few days after, and 5 per cent. more before six months, from hydrocephalus and diabetes.

*Treatment.*—In all cases the usual medical treatment is to be employed, under the care of an expert if possible. The indications for obstetric treatment will largely depend on the success or failure of medical, mainly dietetic, treatment. Alimentary and transient glycosuria need no other consideration. Renal diabetes must be carefully differentiated and watched.

(a) *Before the Child is Viable.*—If a woman comes under treatment with a history of diabetes, and the examination of the urine in the first months shows grape-sugar, especially with acidosis, it is best to terminate the pregnancy at once. The attempt to carry the patient up to term or even to viability of the child is too perilous—either the shock of delivery brings on coma, or some other nervous shock does it, or the disease aggravates dangerously, and, too often, the child dies in utero. If the pregnancy is near viability and the symptoms respond to medical treatment, one may try to tide the woman along with a view to improving the child's chances, even though this hope is only too often illusory—the child dies either before or after delivery. Kleinwächter says we should not consider the child at all.

(b) *After Viability of the Child.*—Since some cases of simple glycosuria occur at this time, and since any interference or even natural labor may evoke a terminal complication, most authorities advise waiting, with medical treatment, and the induction of premature labor only when threatening symptoms arise. Williams—and in this I agree—advises the induction of premature labor in all cases when the sugar-content of the urine does not diminish under appropriate treatment, and especially if ominous conditions are found; such are a history of aggravation in previous pregnancies, polyhydramnion, albuminuria, acetonuria, acidosis, advancing malnutrition (determined by the scale), and progressive weakness. Coma indicates the emptying of the uterus, but the child is almost always dead. If abortion or premature labor is to be induced, no anesthetic is to be employed, and the operation is done with the least possible physical and psychic shock. If an anesthetic must be given, use nitrous oxid and oxygen; next choice, ether. Ergot, adrenalin, and pituitrin may be used only if very necessary. Nursing is not to be permitted. Further child-bearing is prohibited (Duncan, Schade).

**Obesity.**—Fat women are often amenorrheic and sterile. Amenorrheic and sterile women are often fat. Probably the causes of the two conditions are similar, being perhaps due to anomalies of the ductless glands. Pregnancy usually causes deposition of fat about the middle of the body, and many women put on fat during and after the puerperium. A combination of obesity with infantile pelvis is not rare. Obesity, when extreme, may cause abortion, and in some instances puny children have been noted. Edema of the feet and abdomen is often noted. Dyspnea is frequently a troublesome symptom, and in labor the heart must be considered like that of myocarditis. Rupture of the uterus is favored by fatty infiltration of the muscle-fibers. Postpartum hemorrhage is a little more frequent, and manual removal of the placenta oftener necessary, because the thick belly-wall prevents a good *Credé* grasp for the expression. In only one case has the author noticed that the fat of the pelvis obstructed the delivery, and this was at the outlet.

Perineal tears are more common, and, owing to the presence of eczema intertrigo and the locking in of the lochia, the union of the wound is not so successful. Operative procedures are very laborious, and obesity complicated with a very large fetus is a formidable affair. In general, it is best not to prescribe active antifat treatment during pregnancy, but where the obesity, or the condition underlying it, is the cause of frequent abortion or sterility, one should seek to establish normal conditions.

**Osteomalacia**, *malacosteon*, *mollities ossium*, or softening of the bones, is a disease which is very rare in this country, being found principally in Italy, the Rhine Valley, certain places along the Danube River, and in Flanders, though no country is entirely exempt. In America but few cases are reported, mostly importations—Hirst, 3; Williams, 3; and the author had 1 case, an Italian woman who brought her illness from Naples. In pathology the disease consists of an osteomyelitis and osteitis progressing from the marrow along the Haversian canal outward, even to the periosteum. An absorption of the lime-salts of the bone takes place, and later the spaces are filled with an osteoid substance growing in from the marrow. As a result the bones become very much lighter in weight, softer, and sometimes so flexible that a pelvis so affected has been called a "rubber pelvis." The calcium and phosphates absorbed from the bones are excreted, probably through the urine and feces. The bones themselves are very vascular, reddish yellow or brown, and in advanced cases the periosteum remains as a sac filled with marrow and fat. If a cure results, bone salts are again deposited in the osteoid substance, and the skeleton grows very heavy, but the deformities remain. The pelvis, the vertebrae, the ribs, and lastly the long bones are affected in order.



FIG. 437.—WILLARD'S CASE OF OSTEOMALACIA. PORRO CESAREAN AT FIVE MONTHS.

Osteomalacia is a disease of adults, but a case occurring in a girl of eleven is on record. A similar disease occurs in men and in the lower animals. It bears some resemblance to rachitis. Multiparae are much oftener affected than primiparae, and frequent child-bearing seems to be an active factor. It occurs most often in women of the lower classes of poor nutrition and unhygienic mode of life. The actual cause of the disease is unknown. Fehling holds that the abnormal metabolism of the bones is due to a trophoneurosis, a reflex from ovaries in a state of hyperactivity, and the almost uniform success of castration as a cure gives a strong basis for the theory. von Velitz found hyaline degeneration of the vessels of the ovaries, but this is not pathognomonic. Since we know more about the internal secretions of the ductless glands, and since the ovaries have been proved to have something to do with the nutrition and growth of the bones, it seems more probable that the cause of osteomalacia may be found in some disturbance of the endocrine system. Of interest are the experiments of Sant-Agnese, who inserted bits of rib removed from osteomalacic women into rats, and found bone changes, and constantly the *Diplococcus osteomalaciae hominis* of Morpurgo.

*Symptoms* usually first appear during pregnancy—pain in the back and legs, tenderness

the bones, muscular weakness, difficulty in locomotion, a waddling, twisting gait, intention tremor, contracture of the adductors of the thighs and of the levator ani, and, since the weight of the trunk bears heavily on the pelvis, the sacrum and innominates are distorted, the inlet narrowed, and the stature of the woman shortened. Encroachment of the bones on the thoracic cavity causes dyspnea and cyanosis. Softening and separation of the joints, especially the pelvic, have been frequently noted. After delivery, which may be spontaneous, recovery takes place, but since these women are remarkably fertile, usually a new pregnancy soon begins, and with the recurrence of worse symptoms. Finally the stature is 1 to 1½ feet shortened, the pelvis becomes passable to the child, locomotion is impossible, and the gravida becomes bedridden. (For details of the effect of the deformed pelvis on labor see Chapter LIII, Contracted Pelvis.) Rarely spontaneous cure occurs. Fractures of the bones are common (Fig. 437).

Many women—fully one-fourth, in my experience—complain of symptoms during the latter half of pregnancy which resemble very closely those of mild degrees of osteomalacia—pain in the back and over the pelvic joints, also, but rarely, in the sternum and the shoulder-girdle, and difficulty and pain in locomotion. The softening and loosening of the pelvic articulations give the gait a waddling character, and on vaginal examination we find the pelvic bones, but especially the joints, excessively tender. It is possible, too, that the osteophytes of Rokitansky have some bearing on these two conditions.

*Treatment.*—Phosphorus, lime, cod-liver oil, and abundant nourishment are always to be administered, and if the disease is rapidly progressing, the ovaries may be removed. Bossi recommended the administration of epinephrin to limit of tolerance, and claims excellent results. Very recently pituitrin has been also given (Neu). If the patient is pregnant, unless the symptoms are very urgent, wait until term and do Porro cesarean, removing the ovaries. In any case a cure was effected by simple castration at cesarean section. Great difficulty was experienced in stopping the hemorrhage at the operation, an occurrence which von Velitz also met, and which required amputation of the uterus in two cases. For the pseudo-osteomalacic symptoms lime and phosphates are administered (Schnell).

## DISEASES OF THE EYE, EAR, NOSE, AND THROAT

**The Eye.**—Even the ancients knew that sepsis and severe hemorrhages in the puerperium could produce blindness and strabismus, and a connection seemed to be established between the genitals and the eyes for many affections of the latter, but even yet the exact mode of interaction is obscure. Many theories were invoked, as reflex action from the genitalia, retention of poisons which should be eliminated in the menstrual blood (Charrin and Roché), which is a disinterment of the “purification” theory of menstruation; hysteria and neuroses, demineralization of the blood, toxemia, abnormal or insufficient internal secretion of certain organs, especially the ovaries. Probably several of these hypotheses may explain the numerous ocular manifestations which seem to bear relation to gestation.

*During pregnancy* excessive pigmentation of the eyelids is sometimes noted in neurotic women. Tanner speaks of a chromidrosis. Ulcer of the cornea, chorioiditis, and glaucoma may begin or be aggravated, and a few pregnant women complain of scotomata and dyschromatopsia. This may be due to an optic neuritis, which occurs also in the puerperium, may be associated with, and probably is similar to, the polyneuritis of pregnancy. Since atrophy of the optic nerve may result, the pregnancy should be interrupted. Weakness of accommodation and muscular asthenopia are not very rare, and may require temporary treatment. Hemeralopia has sometimes been found to precede the amaurosis of toxemia. Retinal hemorrhage and abruptio retinae are serious complications, usually requiring interference. Teillas observed four gravidæ recover completely from retinal hemorrhages.

Preëclamptic toxemia and renal disease sometimes produce an acute amaurosis, already referred to, which usually is transitory, disappearing more or less completely when the uterus is emptied. It may occur with postpartum eclampsia or independently. The blindness often precedes the convulsions or coma for several days, and is of great prognostic importance. Ophthalmoscopically, nothing can be seen on the retina. It lasts two to six days after consciousness returns, but only leaves impaired vision. It is due, according to Berger and Loewy, to a poisoning of the ganglia and optic nerves, the toxins having a special selective action for

them. Such selective action of poisons is well known—for example, tetanus, strychnin. This theory appeals strongly to the author. Pregnancy seems to dispose to the occurrence of neuroretinitis, with a tendency to hemorrhage and exudates. Posey and Hirst believe that the optic neuritis and retinitis, due to the toxemia of pregnancy, may indicate the basal trouble before changes show in the urine. Acute amblyopia or amaurosis occurring in the course of pregnancy demands immediate urinalysis, and if albumin or other signs of renal or hepatic insufficiency are present, the induction of labor. Another form of amblyopia and amaurosis may develop in the course of renal or hepatic disease during gestation—retinitis albuminurica. This is easily diagnosed with the ophthalmoscope by the hemorrhages and the white spots and lines which show the degeneration of the retinal vessels. These changes may long precede the complaint of loss of vision. Exophthalmos is sometimes associated (Barker). First the women complain of specks before the eyes, dimness of vision, sometimes hemeralopia, colored lights, amblyopia, and finally of complete blindness. Retinitis albuminurica may occur in all forms of kidney disease during pregnancy, but the prognosis is somewhat better than those cases which occur outside of gestation. It is more frequent in the chronic forms of disease, and it always indicates the immediate emptying of the uterus. This is to save the sight and to prevent eclampsia and uremia. Abruptio retinæ may complicate the retinitis. After delivery the sight returns, but usually incompletely, though a few cases of cure are on record. In a subsequent pregnancy the condition usually recurs, but even though it may not, one should always counsel the discontinuance of child-bearing. Edema of the lids, of the bulbar conjunctivæ, and even of the retina are found in nephritis.

During labor hemorrhages in the conjunctivæ and behind the bulb have been noted, also hysteric amaurosis and xanthopsia.

During the puerperium all the conditions mentioned may occur or be carried over from pregnancy. I have seen one case of hysteric amaurosis and several of blepharitis marginalis, of hordeolum, and one of phlyctenular conjunctivitis, which three are generally ascribed to the influence of lactation. Treatment consists of the administration of lime, phosphates, and general roborants. Muscular asthenopia has been noted, and I have seen numerous cases of headache in the puerperium from eye-strain. The women look down at the baby while it is nursing, and the eyes are unaccustomed to such prolonged action. Reading in bed and with poor light may also be causative. A true weakness of accommodation occurs also. The relation of the nasal sinuses to the eye should be remembered.

Optic neuritis may be associated with ulnar or polyneuritis, with the same etiology. In septic cases blindness may result from double retinitis septica, from panophthalmitis, or from embolism of the central artery of the retina.

Severe hemorrhage, especially if associated with other diseases which weaken the optic nerve, may cause temporary or permanent blindness. It may aggravate a myopia and favors optic atrophy. This effect may come on at once, or it may appear after several weeks. It is due to anemia of the retina and nerve or to degenerative changes in them, and lasts a few hours in the first instance, and may be more or less permanent in the latter. Choked disc with blindness has been observed after severe bleedings. It is easily seen how important is the quick restitution of the blood to a normal state, and Berger and Loewy even recommend transfusion with defibrinated blood, in addition to the other usual remedies (Runge, Silex, Shute).

**The Ear.**—Aurists find that pregnancy sometimes unfavorably affects diseases of the ear, especially otosclerosis (Brickner, Milligan). Middle-ear infections grow worse, chronic thickenings increase, and deafness becomes more marked, all of which is especially noticeable in repeated gestations. Ringing in the ears may be a symptom of toxemia, and even deafness may be caused by an auditory neuritis analogous to the same disease of the optic nerve. In cases of rapidly increasing

deafness due to pregnancy, the induction of premature labor is to be debated with the family and attending aurist. It is possible that some of the "fainting spells" to which pregnant women are liable may be due to circulatory disturbances in the labyrinths.

**The Nose.**—A general hyperemia of the nose and throat has been noted by rhinologists, some even claiming that a diagnosis of pregnancy may be made from the nasal findings. Hofbauer proved clinically and microscopically that decided changes exist. The intumescent conditions of the turbinates are subject to aggravation by pregnancy. Sinus disease is not more common. Its treatment is the same as in the non-pregnant condition—indeed, all suppurations of the nose and throat must be cured before labor, because the focus of suppuration may lead to infection of the genitalia or the breasts.

Fliess claims that the anterior ends of the lower and middle turbinates, if diseased, may cause dysmenorrhea, and if cocainized during the attack, the pain ceases, and that cauterization of these areas will cure. My experience with this remedy is small but entirely negative, there having been not even an improvement which might have been ascribed to suggestive action. He also claims that the pains of labor and hyperemesis gravidarum may be favorably influenced in the same way. Epistaxis has been noted with some frequency in pregnancy. Usually an ulcerated spot is not found, the blood coming from rupture of one of the congested capillaries. An ulcer may be cauterized, even though Fliess says that abortion sometimes results from such action. Vicarious menstruation through the nose has been referred to.

Lingual varicosities are sometimes aggravated by pregnancy, and the hyperemia may lead to some hoarseness, but in general the effects of gestation are not prominent. Tuberculosis of the larynx is most unfavorably influenced, the ulcerations becoming deeper and spreading rapidly, and frequently causing edema of the glottis. Pregnancy seems even to predispose to laryngeal tuberculosis. Some singers claim that it injures the voice to sing during pregnancy, and there seems to be a scientific reason for it. It is denied by others.

As the result of violent labor efforts hemorrhages may take place in the mucous membrane of the nose and throat, as well as the ocular conjunctivæ, while after severe blood loss the parts are very anemic. Women who shriek continually during prolonged labor may show on examination redness, edema, and minute blood extravasations in the mucous membrane of the false and true vocal cords and the posterior wall of the larynx. After delivery these changes rapidly clear up.

## TRAUMATISM

Pregnant women bear the effects of violence with varying resistance. Wounds heal with their usual promptness, and the old notion that bones unite poorly is incorrect. Suggillations are perhaps a little more extensive. Violence to any part of the body, but particularly to the genitals, may bring on abortion, but sometimes terrible shock may be without effect on the pregnancy, as in Waldeyer's case of fracture of the sacrum, and one of mine, where I delivered at term a woman on whom an inexperienced surgeon had performed curetage at three months. Bröse reports a case where, after laminaria dilatation of the cervix, through a uterine perforation 2 feet of intestine were pulled out. Laparotomy, resection of the gut, undisturbed pregnancy. Opposed to this may be placed the well-authenticated cases of a slight jar, as from misstep, causing abortion. Operations are to be performed on any part of the body if the indication is real and urgent, but operations of convenience, for example, simple hernia, hemorrhoids, etc., are better postponed. Ovariectomy has often been done successfully in pregnancy, also the removal of fibroids from the uterus itself. The necessity for the ovaries seems greatest in the early months, because if then removed abortion often occurs, while in the later

ones both gestation and labor may be natural. Shock and sepsis are the causes of the abortion when such occurs, though the withdrawal of the corpus luteum hormone has been assigned. Operations on the labia and cervix have been done without disturbing the pregnancy, and even extirpation of the cervix. Then, again, a slight operation on some distant organ or extremity will bring on abortion. It is, therefore, impossible to foretell what effect a given interference will produce. It seems that operations undertaken at the time the woman would ordinarily have menstruated are more likely to bring on pains. Vesicovaginal and rectovaginal fistulas have been cured in graviditate and the local changes in tissues seem to have improved, rather than impaired, the process of wound healing. Anesthetics may be given during gestation, but there is danger of asphyxiating the infant. Probably death of the child causes some of the premature labors recurring after operations. Ether is the safest, and the administration should be as short and as light as possible. A dentist informed me that he had given gas to pregnant women hundreds of times without injury, but in one of my cases of cesarean section, where gas-ether narcosis was used, the child was mortally asphyxiated. Previous to this the woman was in prime condition, and the actual delivery consumed less than three minutes. Operations in the presence of pus, especially if the focus of infection is near the uterus, are more than likely to be followed by sepsis.

Pregnant and puerperal women should be spared mental shocks, if at all possible. Premature labor may result, even fetal death. During labor a shock may suspend uterine action, and cases are recorded where collapse and death result. A shock in the puerperium has been ascribed as the cause of diabetes, acute febrile reaction, dementia, convulsions, hemorrhage, and death. (See "Sudden Death.") A shock, too, will sometimes alter the milk—either dry it up or make it unfit, or poisonous, to the child. How these changes are brought about is still a subject for conjecture.

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## CHAPTER XLI

### LOCAL DISEASES ACCIDENTAL TO PREGNANCY

#### DEFORMITIES OF THE PARTURIENT CANAL

EMBRYOLOGICALLY, the uterus and vagina are formed by the fusion of the two Müllerian ducts, the union taking place from below upward. Lack of fusion at any point or throughout the length of the two canals explains almost all of the anomalies that are observed, and rudimentary development of one duct will account for the balance. All degrees of lack of fusion are to be noted, there being one case on record where two complete, but single and distinct, parturient canals with two vulvæ were found,—*uterus didelphys*,—and it is not rare to find the fundus uteri indented in the middle,—the “*uterus arcuatus*,”—which is just the indication of the upper end of the line of fusion of the two ducts. In some animals the two ducts do not fuse, but two tubular uteri exist.

Not always are the two sides of the uterus and vagina equally developed, and we observe gradations from completeness of the two halves to almost entire absence of one Müllerian duct. The rudimentary side lies as an appendage to the well-developed uterus, but since its canal, four times out of five, does not communicate with the vagina, trouble infrequently ensues, such as hematosalpinx, hematometra, pregnancy in the closed horn, etc. (Ahlfeld, Munde, Santos).

**General Considerations.**—In all these deformities the two halves are usually not symmetric: one or the other horn is larger, or the vaginas are unequal—sometimes one of them ends blind at its lower end. Coitus is rarely interfered with, the larger vagina being used. Menstruation comes from both uteri simultaneously, but sometimes only from one at a time. Pregnancy may occur in one or both horns, twins having been found in one horn. If each horn contains an ovum, the two children may have been conceived at different impregnations and be delivered at intervals, thus raising the suspicion of superfetation. Pregnancy is ordinarily undisturbed, the side not involved growing and forming a decidua similarly to ectopic gestation. The decidua of the empty side may be cast out, while the pregnancy continues on the other side. The course of the case resembles an abortion, and unless the duplicity of the uterus is known, the accoucheur may attempt to curet, thus unwittingly destroying a living ovum. Usually the decidua comes away in the puerperium with the lochia. Müller records cases of menstruation from the empty horn during pregnancy. Abortion may occur, and it may be difficult to clean out the uterus, especially if there is only one cervix. It is doubly important to insert the finger for the curetage. In septic abortions it is necessary to empty both sides. Labor is often normal, but these complications have been observed—weak pains and atony in the third stage, with postpartum hemorrhage; the non-pregnant portion of the uterus may prolapse under the other, and act like a tumor incarcerated in the pelvis; the non-pregnant cervix may be forced down to the vulva with the head; the uterus may rupture, because of poor musculature; the septum in the vagina may be an obstruction. Septate uteri may have these complications: breech and transverse presentations; weak pains; atony postpartum; rigidity of the cervix; placenta on the septum and adherent; and, if the septum is in the cervix, obstruction to delivery. In one of my cases the child traddled the septum. (See van de Velde and Ubbens.)

*Pregnancy in a rudimentary horn* resembles ectopic gestation very closely.

Mauriceau and Vassal, in 1669, put the first case on record, and now over 100 have been described. If the accessory horn is very rudimentary, it may be closed at



FIG. 432.—UTERUS DUPLEX, BICORNIS, CUM VAGINA SEPTA.

*Uterus Duplex, Bicornis, cum Vagina Septa.*  
—One finds two openings into two separate vaginal canals, a cervix pointing into each, and if the os of each of the two separate uterine cavities is open, a finger passed into them will feel a septum separating the two ova. In my case, from which the diagram is drawn, the woman was eight months pregnant, with a child in each horn, O.L.P. and O.D.T., and a deep furrow could be felt between the two sides of the uterus. One horn could be rotated about completely around the other. Fig. 439 shows the appearance of the vulva. Another practitioner conducted the labor.



FIG. 439.—VULVA OF UTERUS AND VAGINA DUPLEX. PREGNANT IN BOTH UTERI (author's case).

both ends, making pregnancy impossible, but an accumulation of menses probable. Should the fertilized ovum be inserted in the small horn, there is no hope of its finding a way into the uterine cavity of the other, because the connecting bridge of

is usually imperforate, or even if the two halves are broadly apposed, the cavities usually do not communicate, or the opening is too small. Hyper-  
y of the muscle-wall of the horn may occur and permit the ovum to grow to

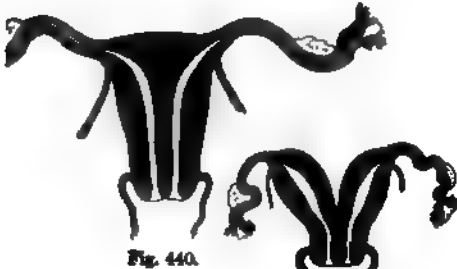


Fig. 440.



Fig. 441.

40 AND 441.—UTERUS SEPTUS DUPLEX, OR UTERUS BILOCULARIS.

*Uterus Septus Duplex, or Uterus Bilocularis.*—One vagina exists, and it is capacious, with marked anterior and posterior columnæ and two cervices, with a falciform ridge between them. In the author's case the woman was pregnant in the left uterine cavity and aborted at the third month. If the fundus also shows signs of splitting, it is called uterus duplex bicornis (Figs. 440 and 441).



g. 442.—UTERUS SUBSEPTUS UNICOLLIS.

FIG. 443.—UTERUS BICORNIS UNICOLLIS.

*Uterus Subseptus Unicollis.*—This is a simple septum in an otherwise single uterus. In one of my cases the septum came down (at term) within an inch of the internal os, which was single. The woman had had five still-births, breech deliveries, all difficult because of a flat pelvis. In the sixth, conducted by the author, the child suffered a depressed fracture of the skull, but survived. In another case the breech presented in each of two labors, and the placenta both times was adherent to the septum. This form of uterus occurs in dogs, camels, sheep, etc. If there are indications that the fundus also is split, it is called uterus subseptus unifornis, or uterus bicornis unicollis (Fig. 443).



—UTERUS SUBSEPTUS UNICORPOREUS. SEPTATE CERVIX.

*Uterus Subseptus Unicorporeus.*—Consists simply of a septate cervix, the rest of the uterus being normal or presenting only an indication of double formation. In the author's case the child, presenting by the breech, straddled the septum, which had to be cut to allow delivery. Both recovered. This condition may be imitated by a cervicovaginal fistula or partial rupture of the cervix in a spontaneous abortion.



FIG. 445.—UTERUS ARCUATUS.

*Uterus Arcuatus.*—This has already been spoken of; it is the simplest and most common anomaly, often causing difficulty in differential diagnosis from ectopic gestation, pregnancy in the tubal corner, etc. It often causes transverse and breech presentations.

but more commonly rupture of the gestation-sac occurs during the middle of pregnancy, and furious internal hemorrhage ensues. Practically, what was said of ectopic gestation applies to this subject. Since there is no communication between the vagina, the spermatozooids must cross over from the open tube to the closed

side, to fertilize the ovum from the ovary on the side of the pregnancy, or the ovum from the open side wanders over to the closed horn before or after fertilization.

The diagnosis of pregnancy in a rudimentary horn is occasionally made, but usually the abdomen is opened for rupture of a supposed extra-uterine pregnancy.

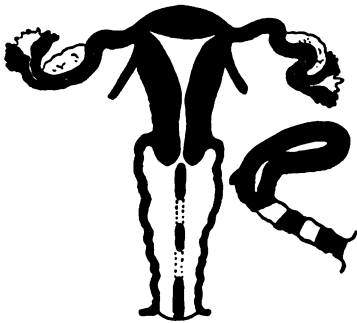


FIG. 446.—SEPTA IN THE VAGINA, IN FRONTAL AND SAGITTAL SECTION.

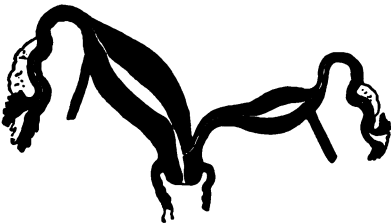


FIG. 447.—UTERUS BICORNIS UNOLATERE RUDIMENTARIUS.



FIG. 448.—UTERUS WITH CLOSED ACCESSORY HORN.



FIG. 449.—UTERUS UNICORNIS.

*Septate Vagina.*—Double hymen is frequently observed, but gives no trouble, either in diagnosis or treatment. A septum may exist at any point of the vagina, or even throughout its whole length. In these cases the lower end of the Müllerian canal failed to fuse, but the upper portions did, forming a perfect uterus. Occasionally there are two cervixes. The septum is usually sagittal, but may be frontal in direction.

*Uterus Bicornis Unilateris Rudimentarius.*—Of great clinical importance, because pregnancy may occur in the rudimentary horn, and such an accident is worse than ectopic gestation, with which it is usually confounded.

Shows the accessory horn closed at both ends, and one can see how menstrual blood will accumulate in it, causing hematometra, or, if the vagina is also partly formed, hemelytometra.

*Uterus Unicornis.*—Here the one Müllerian canal failed to develop. It is normal in birds. Such a uterus may bear children without trouble.

On the specimen it is easy to find the connecting band between the rudimentary and the spindle-shaped larger horn, and to determine that the round ligament and the tube come off from the outside of the gestation-sac. The sac has much muscle at its base. Clinically, on bimanual examination the diagnosis of ectopic preg-

is usually first made; then, when the form of the uterus (spindle shaped in- of pear-like) and the course of the round ligament---on the outside of the sac--- suspicion, one proceeds to palpate out the structures more minutely. Sep-

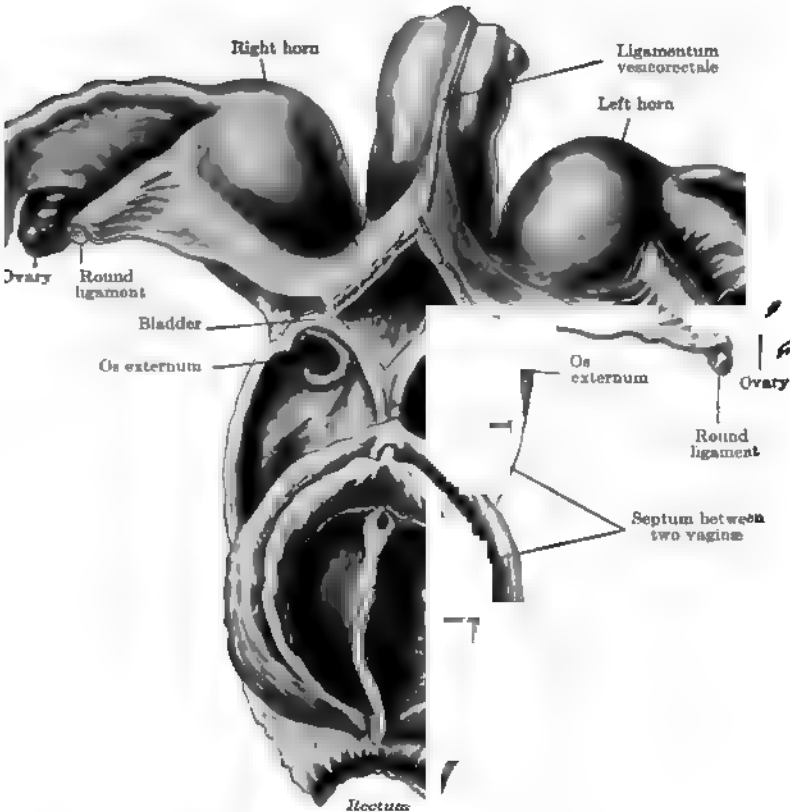


FIG. 450.—DOUBLE UTERUS AND VAGINA.  
From the Lehrkanzel für path. Anat., Vienna, Handbuch der Geb., v. Winckel.

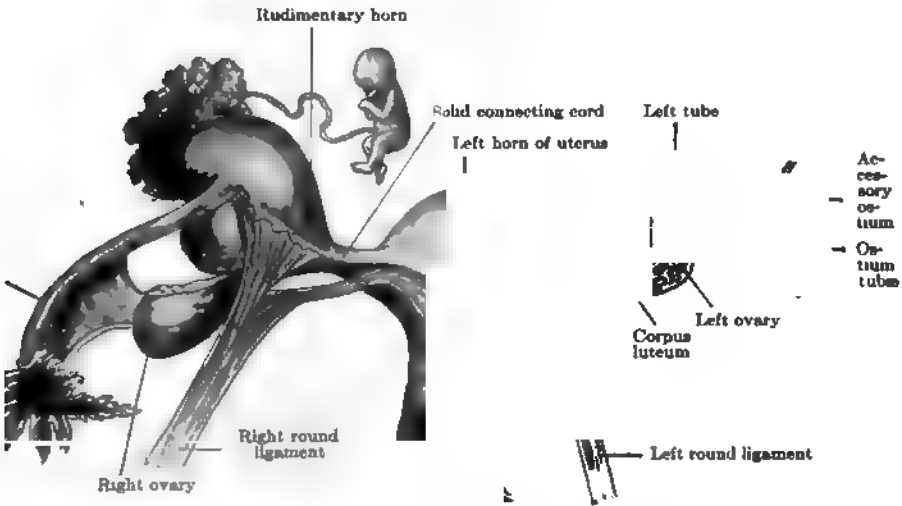


FIG. 451.—UTERUS UNICORNIS WITH RUPTURED RUDIMENTARY HORN.  
The rudimentary horn wandered over from the left ovary. The horn ruptured in the tenth week. The ligaments have been dissected (Luschka, Monatschr. f. Geb. u. Frauenk., vol. xxi, p. 32).

initis. It is easily discovered if the fresh discharge is examined in a hanging-drop under low power.

**Gonorrhea.**—Venereal diseases are of great importance in obstetric practice. Acute gonorrhea is commoner in primiparæ, being conveyed at the time of impregnation. Unlike ordinary cases, where the inflammation is limited to or most marked in the urethra, the vulvar glands, and the cervix, in pregnancy, favored by the tenderness of the tissues, the gonococcus attacks the vaginal and vulvar epithelium in addition to those mentioned. Profuse secretion of greenish-yellow pus results; the vulva is red, sometimes covered with grayish exudate, sometimes ulcerated, or studded with gonorrheal, pointed condylomata; the vagina is thick and granular, like a nutmeg-grater, and bleeds even on light touch; the cervix is swollen, vascular, tender, easily vulnerable, and emits a foul mucopus in which the gonococci are most readily found. Chronic infection is the form usually met, and it has left the surface, covered by squamous epithelium, to localize in the urethra, Skene's tubules, the crypts around the hymen, the Bartholinian ducts and glands, and the cervix,

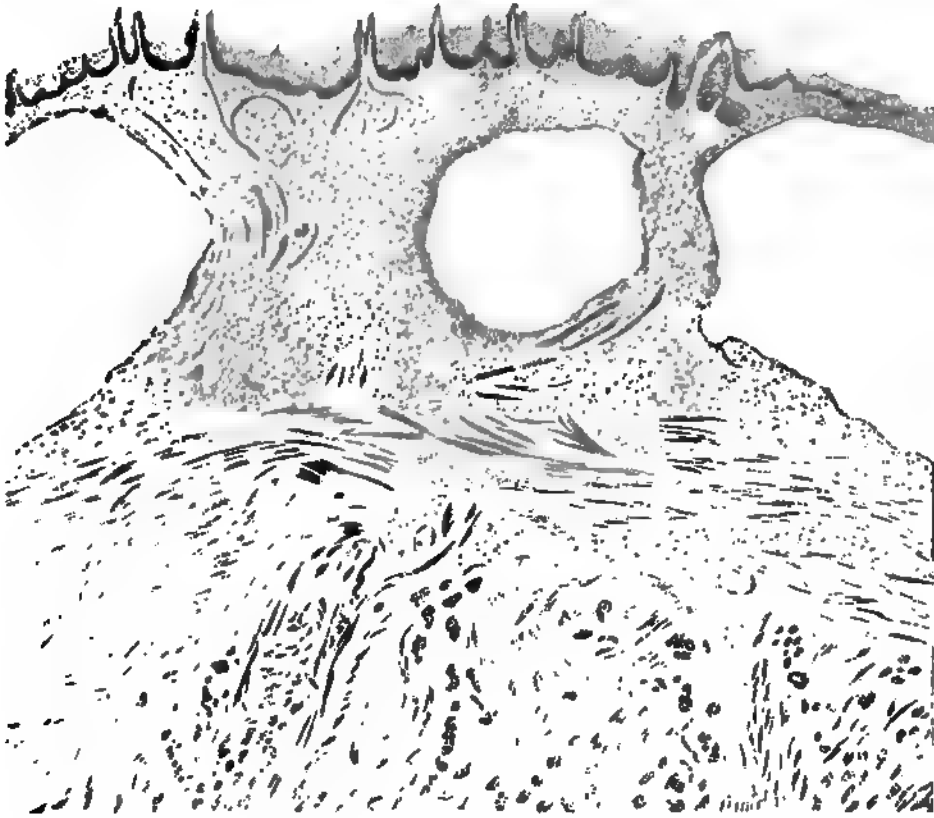


FIG. 452.—COLPITIS EMPHYSEMATOSA.

which it is recognizable by the usual signs. Acute as well as chronic gonorrhea may affect the uterine decidua and produce abortion, but, as a rule, the gonorrheal metritis remains latent until after delivery. Indeed, many women having a profuse mucopurulent leukorrhea are delivered without the accoucheur being aware of the existence of an infection until the baby's eyes show gonorrheal ophthalmia. Through the traumatism of labor the gonococci are pressed out of the deep cervical crypts, and by virtue of the open cervix and the puerperal processes, unlimited opportunities are afforded them for further virulent development. As a result, gonorrheal endometritis, salpingitis, ovaritis, and pelvic peritonitis are set up, reference

of gonorrhea, next of abortion, then of displacements and lacerations of the uterus. These last predispose to infection of the uterine mucosa, and Albert, proves that there is a latent microbic endometritis. Irregular living, congestions during menstruation, sexual excess, abnormal sexual practices, traumatism and infection at childbirth, retention of pieces of membrane, but especially gonorrhea and abortion, cause endometritis. The classifications of the various forms are not fully satisfactory, even to the gynecologists.

During pregnancy the pathologic study of the uterine mucosa is doubly difficult, and without doubt needs reinvestigation with modern methods. Most authors distinguish two main conditions—endometritis deciduæ interstitialis and glandularis. The inflammation is usually present before conception, but may arise during pregnancy, for example, from a syphilitic ovum or from gonorrhea. Fig. 453 shows a piece of decidua vera expelled in an abortion at ten weeks. It is thickened, infiltrated with round-cells, degenerated in places, strewn with minute hemorrhages, and shows a lumpy, uneven, polypoid surface. Virchow first described it as endometritis deciduæ tuberosa or polyposa, or both. The glands may hypertrophy also, while sometimes atrophic areas are found. Syphilis may occasionally cause such changes.

If the glands are affected, either by hypertrophy or by inflammatory hyperemia, a profuse secretion results, which is yellowish, serous, slightly mucous or bloody. Schröder called this endometritis deciduæ catarrhalis, which may give the clinical course of hydrorrhœa gravidarum. Should the mouths of the glands be occluded, cysts containing a milky fluid form in them—the endometritis deciduæ cystica of Breus. It is possible that many of the specimens called by the older writers

decidua with “uterine milk” were of this nature. Endometritis deciduæ is of great clinical importance. It causes relative sterility, frequent abortion, and, since abortion often leaves endometritis, a vicious circle is established—abnormal insertion of the ovum (for example, placenta prævia), abnormal formation as to shape, size, and thickness of the placenta, infarcts, retarded development of the fetus, abruptio placentæ, and thickening and retention of the decidua. During pregnancy one may find pain in the uterus; aggravation of the sympathetic disturbances, especially hyperemesis; painful uterine contractions, sometimes called “rheumatism of the uterus,” particularly at or near term; local tenderness, and, in the more acute cases, slight fever, malaise, and bloody discharge, which arouses a suspicion of abortion. Much depends on the location of the disease and the extent and time of its occurrence. If the decidua serotina is involved, early death of the fetus and

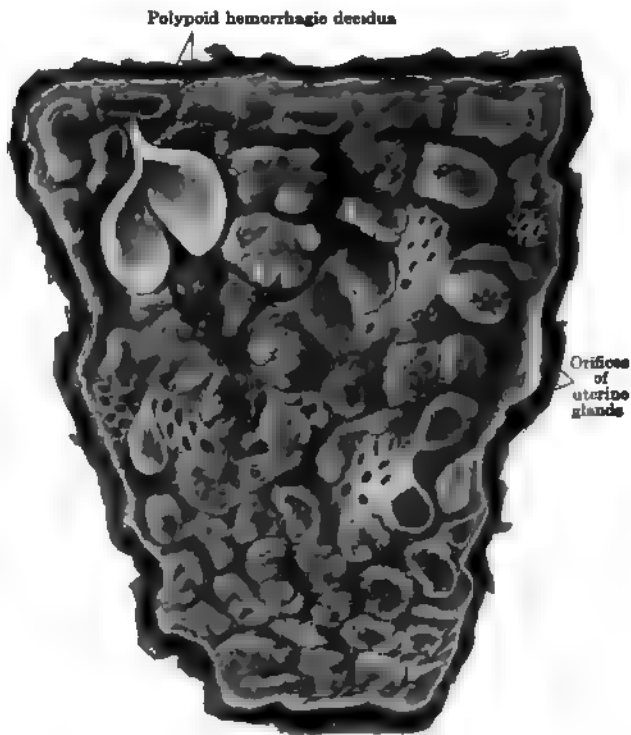


FIG. 453.—ENDOMETRITIS DECIDUÆ TUBEROSA POLYPOSA.

abortion occur, but if the affection is mild, pregnancy may go to term, and one will note only anomalies in the mechanism of placental separation, perhaps placenta accreta. The earlier the disease manifests itself, and the greater its extent, the more the likelihood of abortion. The ovum may be transformed into a bloody or fleshy mole.

Chronic endometritis affects the course of labor. Since usually the muscle of the uterus is involved, weak or painful pains are noted. Premature rupture of the membranes, hemorrhages into the decidua, sometimes at the placental site, with abruptio placenta, abnormalities in the mechanism of the third stage, atonia uteri, from myometritis, retention of bits of placenta or membrane—all these may require obstetric interference. Pieces of thick, hard, cheesy decidua may remain in the uterus after the placental delivery and keep up a prolonged, even dangerous, oozing, requiring manual removal, the same being true of the firm blood-clots which usually surround them. If these foreign matters are allowed to come away in the puerperium, they cause profuse, prolonged, bloody, sometimes fetid, lochia, occasionally slight fever, and always delayed involution.

Evidences of endometritis on the placenta are: Thickened serotina, which may be quite opaque and ragged in places; vascularization of the margin of the closing plate of Winkler, which may extend some distance under the membranes. One may see arteries and veins running in the thick decidua vera for two to four inches.

The maternal surface may be rough, sometimes hard, and there are numerous white infarcts. The contour of the placenta may be irregular, as if it grew easier in one direction than another; there is a tendency to the formation of placenta succenturiata, and placentula succenturiata, also velamentous insertion of the cord. When the serotina, through chronic inflammation, or because of lost tissue through previous operations or disease, cannot react with sufficient decidua, the villi bore into the uterine wall and the placenta is adherent to the musculature—placenta accreta. (See Postpartum Hemorrhage.)

*Diagnosis.*—The diagnosis may be suspected during pregnancy, but even when the symptoms, as given, are present, a certain diagnosis may be made only postpartum. If the condition is suspected, appropriate treatment must be instituted for the prevention of the evil effects, for example, placenta prævia, premature detachment of placenta, postpartum hemorrhage, premature labor.

*Treatment.*—Prophylactically, much can be done to prevent endometritis in, the early cure of gonorrhea, the proper care of abortion, the prevention of sepsis, etc. Repeated abortions due to endometritis may sometimes be prevented by curetage. Bier's suction treatment, etc., not omitting general hygienic measures. During pregnancy no treatment will reach the diseased part unless the latter be syphilitic, and here the appropriate drugs are to be exhibited. It is my custom to give all such patients, whether syphilitic or not, tonic doses of mercury— $\frac{1}{30}$  grain of corrosive sublimate in tablet three times daily. If pallor and general asthenia are present, minute doses of arsenic and iron are added. Lomer uses potassium iodid.

*Hydorrhœa Gravidarum.*—A periodic, or at least intermittent, discharge of clear, yellowish, or sometimes bloody fluid from the uterus has been given this name, and the cause is almost always endometritis deciduæ catarrhalis, but similar fluids may issue from the uterus—first, from the space between the chorion and amnion, and, second, from the amniotic cavity itself, that is, liquor amnii may escape. In typical hydorrhœa the catarrhal secretion accumulates between the vera and reflexa, and periodically breaks through the mucous plug which fills the cervix, or there may be a continuous dribbling. As much as a pint may, but rarely, accumulate, and the expulsion of such an amount often provokes abortion or premature labor. The disease is most common from the third to the sixth month, but may begin or continue in the last trimester. The pathology is not fully understood, except that an endometritis deciduæ is usually back of it. It occurs in anemic and sickly women, especially multiparæ, and may, if slight, be overlooked.



In the differential diagnosis rupture of the bag of waters, rupture of the chorion, and the escape of subchorionic fluid and hydrorrhea are to be considered. The latter two cannot be distinguished from each other, but liquor amnii can often be recognized by the flocculi of vernix caseosa, if late in pregnancy, by the lanugo hairs, and sometimes by meconium. Usually it is impossible to make the diagnosis, and in all cases the patient is treated as if she were threatened with abortion.

Formerly it was held that if the ovular sac opened and the liquor amnii drained away, the uterus would inevitably empty itself within a short period. For the vast majority of cases this is true, but sometimes the membranes, after rupture, shrink up, leaving the fetus in the uterus, but outside of the chorion. Development of the child is much hindered; it is puny, shrunken, with many of its joints ankylotic, and showing decubitus over bony prominences. In addition to this form, or graviditas exochorialis, another variety exists: the amnion breaks, but the chorion does not, and the shrunken amnion is found hanging around the insertion of the cord, but the chorion is intact—graviditas examnialis.

*Endometritis Syphilitica.*—This was considered under Syphilis (p. 499).

*Bacterial Endometritis.*—Gonorrheal endometritis has already been mentioned, as also have the acute processes which complicate the infectious diseases. Tubercular endometritis may occur in consumptives and in miliary tuberculosis. In one of my cases a tubercular peritonitis developed acutely, after a physician, a sufferer from phthisis, had cureted the patient without sterilizing his instruments. Streptococci, staphylococci, and *Bacterium coli commune* (author) have been demonstrated in the uterine decidua, and, in addition, other unidentified kinds. It is generally held that while the vagina may harbor pathogenic bacteria, they live a saprophytic existence there and do not wander up into the uterus. A few authors believe that, under favorable circumstances, such a transference of infection may occur, and to me this appears very probable. Clinical experience points to it—for example:

Mrs. W., aged thirty-six, quartipara, four months pregnant, with large, patulous os, sickens with fever, chills, and general evidences of serious disease, but with the single local finding, a slight fetid vaginal discharge. Attempts at criminal abortion absolutely excluded: patient desired this child, having arranged the time of coitus. Curetage showed the decidua in lower portion of the uterus, gray, discolored, and soft. After operation, chill and sharp fever, which subsided gradually.

Mrs. C., multipara at term. On complete dilatation of the cervix the membranes were ruptured and a quart of unbearably fetid, thin, meconium-stained, gray-green liquor amnii escaped. Delivery normal; puerperium normal; child survived. In another similar case the child suffered from fever and severe icterus for weeks.

The endometrium may acquire infection either through the cervix, as in the first case, through the blood, as probably occurred in the latter instances, or from an infected organ nearby by contiguity, *e. g.*, an appendix, adherent bowel. Le Count showed specimens demonstrating embolic bacterial endometritis. It is certain that germs can permeate the membranes both from the cervix and from the uterine wall, as in adherent appendiceal abscesses, thus infecting the fetus.

Under this caption should be briefly mentioned the *fever of pregnancy*. No one believes that the processes of pregnancy are ever normally attended by fever. Seitz collected numerous cases which tend to show that a bacterial endometritis can cause fever during pregnancy, subsiding when the uterus is emptied. Uterine pain, tenderness, even local peritonitic symptoms were present in a few of the cases; repeated abortion with bacteria in the decidua; eclampsia, hyperemesis, in others. Coitus carries feces and other contamination into the vagina, and it is more than probable that infection of the ovum frequently thus takes place, with consecutive abortion, which may or may not be followed by general sepsis. If Albert is correct, that a microbic endometritis can cause eclampsia, it is now easy to explain why eclamptics are so prone to puerperal infection in spite of most rigorous asepsis and antisepsis. Evidently, here is a fertile and unexplored field, but this much is to be said—a most thorough and painstaking general examination must be made, and a

diagnosis of bacterial endometritis may be reached only by exclusion. The relation of such infections to puerperal fever will be taken up later.

Salpingitis causes sterility because it is almost always bilateral and occlusive. Chronic tubal inflammation may heal, but the folds of the mucosa have usually become glued together, and this is a frequent cause of ectopic gestation. Double pus-tubes, of course, preclude pregnancy, but sometimes a pus-tube forms after conception has occurred, the woman having been infected and impregnated at the same time. In rare cases a tube adherent to a gangrenous appendix may become infected. Acute salpingitis is a very serious complication of gestation, and without doubt is the hidden cause of numerous cases of sepsis in pregnancy intrapartum and postpartum. During gestation the diagnosis is almost impossible; a peritonitis will be assumed, and if the symptoms are urgent, laparotomy will have to be performed. During pregnancy a departure should be made from the method of treatment of pyosalpinx. Labor will almost certainly rupture the abscesses, and it is, therefore, best to remove the sacs. It is a question whether it is advisable to wait for the contents to become sterile. If at operation there is reason to believe that the streptococcus is associated with the gonococcus, it may be wisest to extirpate the uterus at the same time that the tubes are removed, but the prognosis is bad in such cases. (See Brindeau.)

Peritonitis in pregnancy arises from appendicitis or salpingitis, rupture of the infected bladder in uterine incarceration, from necrosing fibroids, infected ectopic gestation-sacs, twisted ovarian tumors, and after attempts at criminal abortion. In many autopsies performed by the coroners catheters, knitting-needles, hat-pins, etc., have been found in the belly, usually embedded in pus.

Tuberculosis of the peritoneum practically always causes sterility. It is of special interest from the standpoint of differential diagnosis from pregnancy, many grievous mistakes having been made. Montgomery relates the sad case of a refined English woman who fled to America to escape the gossip of her former friends about her growing abdomen, and at the autopsy, held in New York, the finding of a tubercular peritonitis justified her oft-repeated assertion of innocence.

Rupture of an extra-uterine pregnancy may simulate an acute peritonitis, and there may be even fever of 102° to 103° F. to render the diagnosis difficult. In all cases of acute peritonitis in early pregnancy criminal practices are first to be thought of, and the abdomen is to be opened at once.

Chronic peritonitic adhesions have already been considered in connection with distortions and displacements of the uterus. Pregnancy, by the softening and vascularization of such bands, may be actually curative, the rising uterus stretching and breaking them. This process may be attended by more or less pain, and in several such cases the author had to prescribe rest in bed and opiates. Labor in such patients may be slow and tedious. It is believed that "missed labor" occurs more often under these conditions.

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## CHAPTER XLII

### PREGNANCY COMPLICATED BY NEOPLASMS

**TUMORS** in and near the uterus may cause serious trouble before, during, and after delivery, though of late years the cases are not so frequent nor so formidable as formerly, because most of the tumors are removed when found, and, further, owing to modern asepsis, infections are almost always avoided, and operations during labor more successful.

#### FIBROIDS

*The effects of pregnancy on myomata* are well known and appreciated. It is not believed that the changes incident to gestation directly cause myomatous formations, though perhaps the infections postpartum may lay the foundation for their

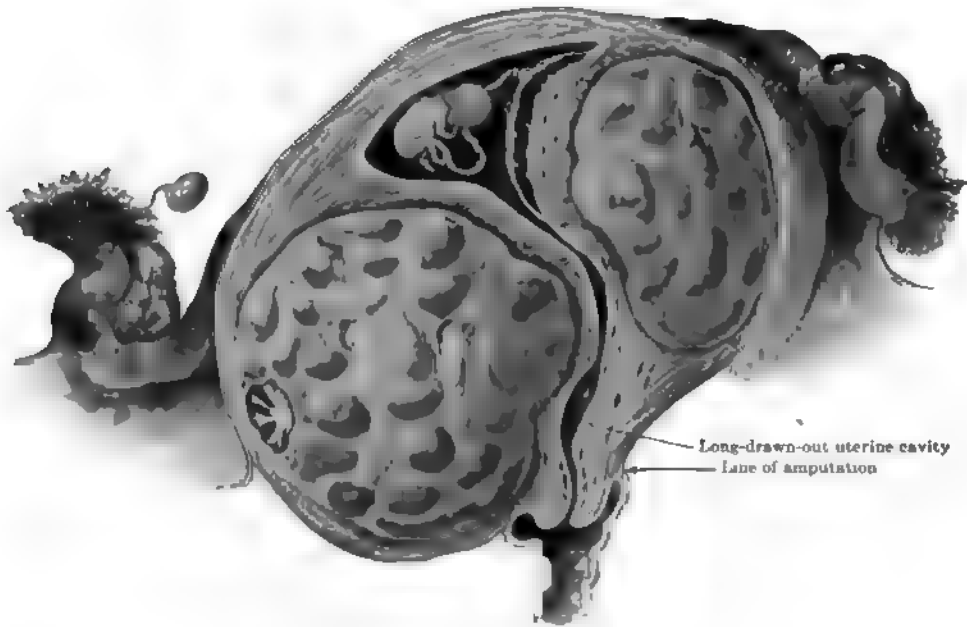


FIG. 464.—FIBROIDS AND EARLY PREGNANCY, MRS. G.

*Tertipara.* Excessive pain and irregular hemorrhages during the first months of pregnancy. Supravaginal amputation of the uterus. One ovary left. Cyst developed in it two years later.

future development. During pregnancy fibroids which were not noticeable before take part in the general succulence and hypertrophy of the uterine muscle, enlarge, and are discovered. Larger fibromata, especially if located in the pelvis, may grow so much that incarceration and dangerous compression of the pelvic organs result. Aside from hypertrophy, hyperplasia, and the increased vascularity of the tumor, cystic and other degenerations, and in rare instances suppuration and gangrene, may occur. The so-called red degeneration is one of the most serious. Peritoneal irritation, even adhesions, in the absence of gangrene, are sometimes caused. Another result of pregnancy is the dislocation and change of shape of the tumors. Myomata attached to the cervix respond to the upward traction of the fundus uteri

and rise into the abdomen, which is fortunate, because otherwise they would block delivery. This retraction of the tumor above the brim may occur even during labor, and the accoucheur may be most agreeably surprised to find what promised to be a formidable case become a simple matter. The fibroid may be flattened by the growing ovum, or, if there are several tumors, they may be separated from each other. Subserous myomata may become twisted and necrose, or they may prolapse into the pelvis; interstitial tumors usually become more superficial; submucous fibroids are likely to become polypoid and may then be extruded through the cervix during the puerperium. During labor the fibroids may be crushed by the advancing head, by attempts at delivery, or by too strong "Credé" expression. In the puerperium myomata usually undergo involution with the rest of the uterus.



FIG. 455.—MRS. K. MYOMETRIAL CERVICAL FIBROID AT BEGINNING OF LABOR.

Many authors report the total disappearance of the tumors as the result of involution, but I have not observed it in the few cases I have been able to follow up, the tumors all having been found as large as, or even larger, than they were before pregnancy, though smaller than they were during gestation. Landau says the same. Necrosis and infection of the tumors occur, but this accident is unusual, is favored by immense size of the growth, by bruising during delivery, but particularly by infection, which is invited by the wounding of the endometrium over the tumor. The fibroid may be converted into a necrotic, purulent mass which breaks into the bladder or discharges per vaginam, a cure thus being effected. Sometimes the uterine contractions deliver the tumor outside the cervix or vulva, the capsule breaks, and the myoma escapes through the rent, but more often gangrene sets in, requiring operation.

The influence of pregnancy on the symptoms caused by myomata is also one of

**aggravation.** Pain was marked in all my cases, hemorrhage, simulating threatened abortion, in four. If the tumor is large, the symptoms of abdominal overdistention result—constipation, dysuria, dyspnea—together with wasting and even cachexia.

*The effects of the fibromata on the pregnancy* are very variable. Women with such tumors are frequently sterile, and though Martin says this is not true, larger statistics seem to prove it. Abortion is more apt to occur, especially with the submucous varieties. The interstitial have less influence, and the subserous, unless large or near the cervix, hardly any. Placenta prævia seems to be favored by the presence of uterine tumors, probably through the concomitant endometritis or edema. Retroflexio uteri gravidi, with incarceration, has been noted; also ectopic pregnancy. In labor the fibroids usually do not give trouble unless impacted or



FIG. 456.—MRS. K. SAME FIBROIDS AFTER COMPLETE DILATATION OF THE CERVIX.

adherent in the pelvis, or unless the placenta has attached itself to the tumor. A subserous impacted myoma causes the worst trouble, because it is less likely to be elevated by the contracting and retracting uterus (Figs. 456 and 457). Interstitial tumors may be flattened against the wall of the pelvis, so that they allow the child to pass; they may be retracted upward, or, if low in the cervix, they may be pushed out of the vulva, even delivered free, thus permitting the birth of the child. The last occurrence is more likely with fibroid polypi. Fibromyomata exert an influence on the mechanism of labor. The uterine contractions are usually strong and painful; indeed, when delivery is blocked by the tumor, rupture of the uterus may ensue; on the other hand, weak pains, even atony, may be present; abnormalities of position and presentation, face, forehead, breech, shoulder, are prone to occur; prolapse of the cord, interlocking of the fetus and the tumor, and inversion of the uterus have also been noted.

In the third stage hemorrhage is very common because the distorted uterus has difficulty in closing the vessels of the placental site. Anomalies in the separation of the placenta are especially apt to occur when it is located on the tumor, since pathogenic adherence is the rule in such cases. If the uterine canal is kinked, the placenta may be incarcerated, and even the best operator may not be able to remove it.

During the puerperium fibroids may obstruct the lochial flow and cause lochia metra; they always delay involution; they predispose to phlebothrombosis, and when they are infected, the worst forms of sepsis may result.

**Diagnosis.**—Most complicated diagnostic problems are here presented to the



FIG. 457.—SUBSEROUS MYOMA IN PELVIS. REMOVED THROUGH POSTERIOR COLPOTOMY

obstetrician, and mistakes without number have been made. If a woman who is known to have myomata becomes pregnant, the diagnosis is not difficult and will be based on some of these points: Cessation or irregularity of the menses; the sympathetic symptoms and breast signs, the rapid enlargement of the uterine tumor; development on it of a soft area; the contractions of the uterine tumor; and, in the second trimester, the fetal heart-tones. All these may be equivocal except the last, and even the fetal heart may be inaudible because covered by an immense tumor. If the diagnosis of the existing pregnancy is made, it is usually easy to determine that there are fibroids in addition, but here, too, mistakes have occurred. A twin, an ovarian tumor, pyosalpinx, double uterus, abdominal wall fibromus-

t, hematoma, Littre's hernia, etc., having been taken for uterine tumors. During delivery the myomatous nodules are made prominent when the uterus hardens, and unless hidden behind the uterus, are almost always discoverable. They may be mistaken for other tumors or a second child. Forceps have been applied to a myoma which imposed as a fetal head. If located in a position which causes interference with the mechanism of labor, new problems are presented for diagnosis. When the uterus is emptied, its large size and the presence of nodules will easily indicate the trouble, though on one such occasion six talented gynecologists, from external examination, diagnosed a second twin. In the puerperium the fundus remains high, involution proceeding very slowly. Infection of the tumor is announced by the usual signs of sepsis.

The differential diagnosis between a large symmetric interstitial fibroid and pregnancy is sometimes one of the most difficult to make. Times innumerable the belly has been opened and only the normal pregnant uterus found, and, indeed, it may be almost impossible to distinguish the two, even after the tumor is out of the belly, in the hands of the operator.

In such a case much weight is to be placed on careful and repeated examinations made before operation:

## MYOMA

Symptoms, as nausea, etc., usually absent.  
Menses present; breast signs almost always absent.  
Uterine tumor usually asymmetric or nodular.  
Tumor usually hard.  
Contractions of the tumor excessively rare.  
Round ligaments, tubes, and ovaries anomalously located.  
Cervix retracted, high in pelvis, hard, and a sort of appendix to the tumor.  
Auscultatory signs of pregnancy absent.  
X-ray negative unless tumor is calcareous.

## PREGNANCY

1. Present.
2. Menses absent; breast signs present.
3. Usually symmetric or characteristically deformed.
4. Soft.
5. Usual and involve the whole organ.
6. Normally placed.
7. Cervix low in the pelvis, large, soft, and part of the uterine wall.
8. Almost always present.
9. May outline skeleton of fetus.

After the belly is opened, the differential diagnosis is made by the darker color of the pregnant uterus, the congested, thickened tubes and ligaments, the presence of a large corpus luteum in one ovary, ballottement, the contractions of the tumor, which molds itself on the promontory, while a fibroid is usually lighter in color, rests heavily on the promontory, is asymmetric, and the experienced operator usually can determine from the feel whether or not a pregnancy exists. One might pass over the tumor with a sterile stethoscope. If the doubt cannot be dispelled, it is justifiable very slowly to cut into the tumor, layer by layer, and, should an amnion be discovered, unless other indications exist, the wound is to be immediately sutured and the belly closed. Pregnancy is usually not interrupted by the exploratory operation.

**Prognosis.**—Without doubt the dangers of myomata complicating pregnancy are misrepresented by the reports, which is due to the fact that only the bad cases are considered worthy of publication. Unless the tumor obstructs delivery, recovery is the rule, but the fetus is more endangered.

**Treatment in Early Pregnancy.**—Since the majority of pregnant women with fibroids go to and through labor without difficulty, it is almost never necessary to induce abortion on their account. Indeed, the interruption of pregnancy is difficult because of the distortion of the uterine canal, and dangerous because of the hemorrhage and liability of infecting the tumors. Excessive pain and repeated and profuse hemorrhages may require treatment, and if ordinary means do not suffice, an operation may be necessary. It is best, wherever at all possible, to wait until term or near it before operating. It may even be wise to try

**liable to set in afterward.** In making a reposition of the tumor the utmost gentleness is to be practised, because its capsule may be ruptured or its pedicle injured, resulting in intra-abdominal hemorrhage or sloughing, with subsequent peritonitis. In trying to pull a fibroid out of the pelvis with the belly opened much aid is afforded by an associate pushing the tumor upward gently from below. If, now, the delivery can be accomplished through the vagina and the operation completed without establishing connection between the peritoneal cavity and the parturient canal, a distinct advantage is gained.

Operations in the uterine cavity, as version and manual removal of the placenta, may be rendered laborious by obstructing fibroid tumors, and it may be necessary to push up or even extirpate the masses before the hand can be introduced. Removal of a placenta adherent to a submucous fibroid may require the digging-out of the two at once, whereby care is observed not to puncture the uterus. In such an event, or if the extraction of the placenta fails, abdominal section would be indicated. If not in position to perform major operations, and finding it impossible to remove the placenta, the accoucheur should pack the uterovaginal canal firmly with gauze. After forty-eight to sixty hours of tamponade the placenta will usually be found loose enough for easy delivery.

During the puerperium, unless symptoms are present, the myomata are not disturbed. Ergot is best omitted unless the tumor is pedunculating itself ready for extrusion and the same is to be hastened. Hemorrhage may require one or more tamponades, or immediate operation. Sloughing, pedunculated tumors are removed per vaginam, but not oversoon, unless they bleed. Trust nature a little. If the tumors become infected, at first expectancy is practised, until the immunities of the puerpera are developed. Precipitate laparotomy might cause fatal peritonitis. During a laparotomy for sloughing fibroids the peritoneum is to be walled off as carefully as at all possible, and the cutting across of the pedicle, after ligation of the broad ligaments, done with the Paquelin cautery. Drainage through the vagina follows. The peritoneum must not be contaminated.

#### CARCINOMA CERVICIS

Of 24,200 consecutive obstetric cases at the Chicago Lying-in Hospital and Dispensary, only one was complicated by cancer of the cervix, and since the service here most closely resembles private practice, as opposed to an exclusive hospital service, this may be taken as a fair index of the frequency of the condition, though Sarwey, combining many statistics, gives the ratio as 1 to 2000 labors, which agrees with Kerr's figures. To the fact that cancer occurs mostly in the non-reproductive period, we can ascribe its rarity as a complication of pregnancy. It occurs almost exclusively in multiparæ. It is a most unfortunate complication, since of reported cases 43 per cent. of the mothers and 60 per cent. of the children died during labor (Wertheim and Bainbridge, 1918).

The effect of pregnancy upon the cancer is unfavorable. Rarely the growth begins after conception; usually the pregnancy supervenes after the cancer has started. Owing to the vascularization and lymphatic imbibition of the cervix caused by pregnancy the tumor grows fast and invades the lymphatics and glands very quickly. Hemorrhage and necrosis, with putrid, sanious leukorrhea, are very marked in all cases except the slow-growing epithelioid varieties. Labor may break up the tumor, the more or less deep lacerations causing hemorrhage, sepsis, and rapid extension of the neoplasm. In the puerperium the last-mentioned changes become evident, but the prostration and quick cachexia are most striking.

Upon pregnancy, labor, and the puerperium cancer of the cervix exerts a bad influence. In the first place, sterility is the rule in cancer, especially in advanced cases, for obvious reasons; second, abortion is frequent, because of the endometritis usually present, the infection and death of the ovum, the hemorrhages, and the



restriction of the growth of the uterus by the neoplasm. Labor is obstructed, not so much because of the size of the mass, as because of the rigidity of the cervix produced by the carcinomatous infiltration. If the tumor is soft and takes up part of the cervix, the rest may dilate and allow the child to pass. If the whole cervix is involved and in a hard mass, obstruction is produced, and the case is formidable. Placenta prævia is a not very uncommon complication, and because of the friability of the uterine wall near the tumor, rupture of the uterus may occur if the pains do not quickly succeed in overcoming the resistant cervix. Should the cervix give way, the tear may extend up into the parametrium, giving rise to terrific hemorrhages, which, owing to the friable nature of the parts, cannot be stopped by suture. Missed labor has been observed, also premature rupture of the membranes, and primary and secondary uterine inertia. Sepsis is common in the puerperium, and a cancerous puerpera is a menace to other puerperæ in the same ward.

**Diagnosis.**—Every woman who has irregular hemorrhages or purulent or putrid leukorrhea should be examined for cancer of the uterus, and even if the menopause has taken place, pregnancy should be suspected when the uterus is found enlarged. The usual criteria of cancer are available, and the tumor, hard and nodular, is more easily differentiated, since the cervix is softened. I have on three occasions found a hard, nodular, but not ulcerative condition of the cervix during the middle of pregnancy, attended by slight bleedings and fetid discharge, but which were not carcinomatous and which disappeared after delivery. It is wise, therefore, in doubtful cases to examine a piece of the tumor microscopically. Pregnancy will not be interrupted by exsecting a bit of the cervix.

**Treatment.**—If an operable cancer of the cervix is discovered in the early months of pregnancy, this question arises: In view of the fact that recurrence in such cases is so quick after delivery and the woman, therefore, doomed to early death, would it not be best, in the interests of the child, to wait until the termination of pregnancy? Pinard, Pozzi, and most French authors say yes, but the German and American authorities believe in the immediate radical operation. The family must decide, it being explained to them that, by waiting, the time for radical cure, which obtains in 25 per cent. of cases, is lost, and the cancer may become inoperable, the death of the woman being thus hastened by at least two years. If operation is chosen, the abdominal extirpation offers the best hope of cure, but the vaginal route still has many adherents. Spencer, Glockner, and Beckman found 50 and 82 per cent. of cases of cancer in pregnancy operable.

Should the carcinoma be discovered when the child is near viability, it may be justifiable, in its interest, to wait a few weeks. After viability there is no question as to the necessity of interference in operable cases, and most authors agree that the vaginal cesarean section, followed at once by extirpation of the uterus, is the operation of choice. Technically, the operation is rendered difficult by the rigidity of the parts, and, if the cancer is on the anterior wall, it may require careful dissection to free the bladder, but this is absolutely necessary. In the extirpation of the uterus which follows the delivery of the placenta it may be helpful to split the uterus in two. Zweifel recommended cesarean section and amputation of the uterus, followed by extirpation of the cervix and tumor from below. English operators prefer the abdominal panhysterectomy after delivery of the child, and proceed in the same fashion as in non-pregnant cases.

When pregnancy supervenes on an inoperable carcinoma, the woman is allowed to go to term, and local treatment, as curetage, cauterization, and tamponade, performed only if hemorrhage or sepsis demands it. Abortion is not invariably produced by such interference. At term, pains are not awaited, but cesarean section is performed, the uterus amputated as low as possible, the peritoneum closed over the stump, and a drain through the cervix into the vagina left.

The radium and x-ray treatment of cancer as yet cannot be considered during pregnancy.

## OVARIAN TUMORS

Much rarer than fibroids are ovarian tumors during pregnancy. Since cysts of the ovary are quite common, the conclusion is justified that they predispose to sterility. In 862 cases collected by McKerron, simple and multilocular cysts occurred in 68 per cent.; dermoids, in 23 per cent.; fibromata and solid adenomata, in 2 per cent., and malignant neoplasms, in 5 per cent. In 1316 cases Welch found 27 per cent. dermoids.

The influence of pregnancy on the tumor is usually not bad, most women going to term without the knowledge of its existence, and the growth of the neoplasm is not accelerated, as in the case of fibroids. While dyspnea, palpitation, etc., due to excessive size of the tumor, are exceedingly rare, torsion of the pedicle, hemorrhage into the cyst, suppuration, and necrosis have occasionally been noted. Labor exerts no influence unless the tumor lies in the pelvis, exposed to the traumatism of delivery. In this case it may be crushed or burst, or its pedicle torn, while in some instances the advancing head has forced the tumor through the rectum or the vagina outside the body—a spontaneous ovariectomy. The puerperium shows no special influence, but complications are likely to arise as the result of the bruising of the tumor. Torsion has been observed much more frequently than usual.

Pregnancy is but little affected by ovarian cysts. Abortion is commoner only with those tumors which are very large or are incarcerated in the pelvis, interfere with the growth of the uterus, or become twisted or infected. Hydatid mole has been frequently observed, sometimes with lutein cysts. Upon labor, ovarian cysts exert a bad action only when they are incarcerated in the pelvis and block the path of the child. To a certain extent, but not so much as with fibroids, nature helps herself by drawing the tumor out of the way by means of the pedicle, and a small or soft tumor may still allow the passage of the child. A soft tumor, however, when it diminishes the available pelvic cavity, is far worse than an equal amount of contraction caused by deformed pelvis. Malpresentations and uterine inertia are common. The puerperium is often stormy, since, because of the bruising of the tumor, necrosis, hemorrhages, infection, suppuration, sometimes with breaking of the pus into the neighboring organs, occur. Tumors which become adherent to the rectum are likely to be infected with colon bacilli. Dermoids, in the writer's experience, are the worst cases in all respects, and if they burst during labor fatal peritonitis may result.

**Diagnosis.**—In the early months it is usually very easy to differentiate the pregnant uterus from the rounded, movable, pedunculated tumor lying at its side, but sometimes great difficulties are encountered. When the tumor is intraligamentous or prolapsed in the pelvis behind the uterus, a careful differentiation from toxic gestation and retroflexed gravid uterus must be made. Both of these have already been considered under their respective headings (*q. v.*). A large tumor may conceal the uterus and pose as a pregnancy, and since the signs and symptoms of the latter are present, the mistake is very likely to be made. Fibroids, leiomyomas, even renal tumors must be drawn into the differential, and one should remember that torsion of an ovarian cyst produces a picture resembling ruptured toxic pregnancy.

In the later months, and during labor, the location of the tumor causes a variety of difficulties. If high in the abdomen, it may slip under the liver or spleen. If adherent to the uterus, the suspicion of twins, of fibroid, or double-horned uterus, arises. If attached to the pelvis low down, a shoulder presentation may be thought of.

In one of my cases a dermoid was adherent to the promontory of the sacrum and could just be reached by the examining finger. If the head had not been pushed forward over the pubis by something behind the uterus, it is more than probable that the tumor would have been overlooked. Tumors incarcerated in the pelvis

during labor are very easily discovered, but their nature and origin are not so quickly determined. A cyst under the compression of labor becomes as hard as a fibroid, and if it is adherent, may simulate a tumor of the pelvic periosteum, as occurred in one of my cases. Rectal examination will exclude this class of neoplasms. An ovarian cyst has been held to be the head of a second twin, and forceps applied; a fibroid—and enucleation attempted; a prolapsed kidney; a full rectum; a hematoma.

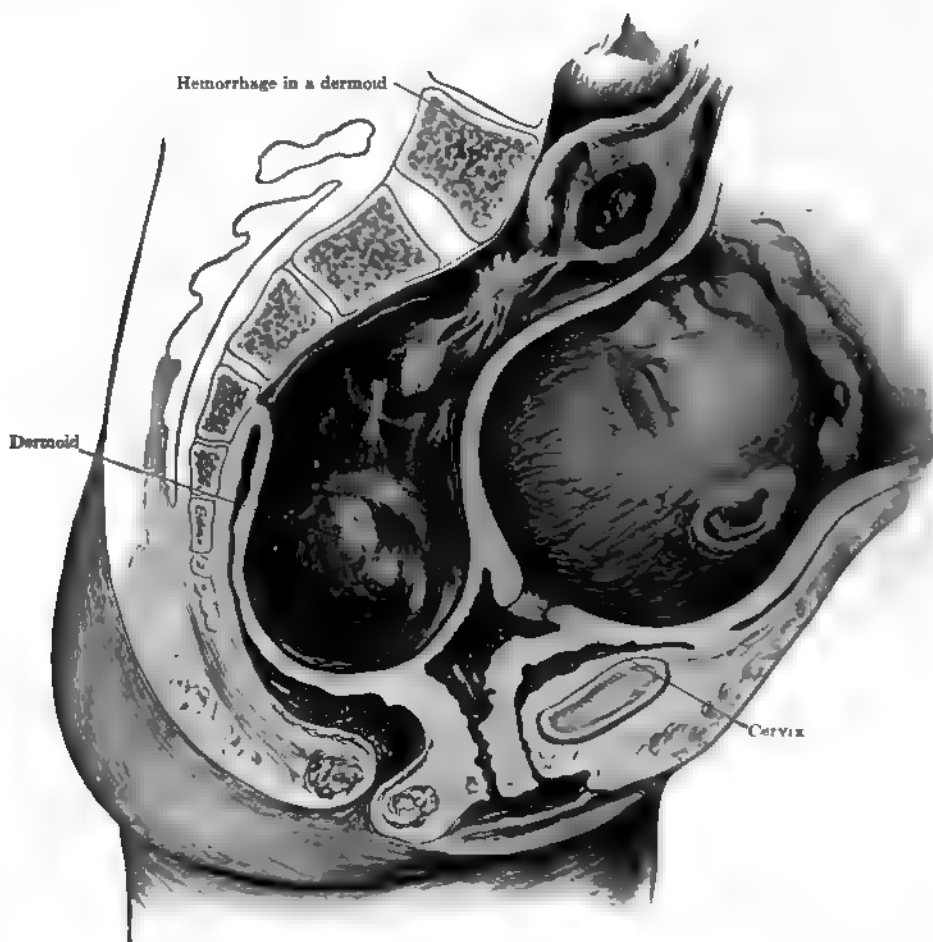


FIG. 458.—MRS. K. THREE DERMOID TUMORS, ONE BLOCKING THE PELVIS. Replacement. High forceps. Ovariectomy. Recovery.

An important part of the diagnosis is the decision as to whether the tumor will block the delivery, and in estimating this one must never forget to measure the bony pelvis also.

**Prognosis.**—Nowadays few women die from this complication because the tumors are usually removed as soon as found, and because operation is substituted for the brutal obstetric deliveries of the olden time. Marshall, in the latest collection, finds a maternal mortality of only 3.3 per cent. in cases operated on during pregnancy, and 5 per cent. after laparotomy at term. I believe this is too favorable a report, since many bad results are not published. Wertheim quotes two statistics—39.2 per cent. and 31.3 per cent. maternal deaths—for cases treated expectantly. Puerperal fever found 6 per cent. maternal and 23 per cent. fetal mortality.

**Treatment.—During Pregnancy.**—Most authors are strongly in favor of immediate removal of the tumor when discovered, but the writer agrees with Fehling and Martin that here, as always, one must individualize. Operation is the rule, preferably laparotomy, though Dührssen urges the vaginal route. Abortion follows the operation in 22.5 per cent. of cases (Orgler), (16.5 per cent., Puech), and even though it follows in 17 per cent. of cases treated expectantly, it may be wiser to postpone the removal of the tumor until the last month of pregnancy or during labor or the puerperium. Such exceptions to the rule would be: (1) Small, freely movable tumors high in the abdomen; (2) an aged primipara in whom the probability of further pregnancies is slight; (3) double ovarian tumors where the woman has no children and desires offspring. In these cases, if operation must be done, a part of the ovary and that portion carrying the corpus luteum should, where possible, be left. Should the patient, after the situation in all its bearings has been explained to her, decide to wait, she must be instructed to report at once any untoward symptom, and as the time of her confinement approaches, seek a good maternity hospital. If the pelvis is not obstructed, labor may be allowed to take place as usual, and the tumor extirpated with deliberation a few days afterward.

Indications for immediate operation in pregnancy are: Suspicion of malignancy; torsion of the pedicle; signs of infection of the tumor; overdistention of the belly. If general anesthesia is employed, ether should be used; the pregnant uterus must be handled as little and as gently as possible, and morphin is to be given for several days afterward in an attempt to restrain uterine action.

**During Labor.**—A sharp distinction is to be made between cases in the hospital under the hands of the obstetric surgeon and those at home in the care of the family practitioner. The location of the neoplasm; the state of the parturient canal as regards infection, and the tumor as regards prolonged pressure, bruising from attempts at reposition, delivery, etc., are also to be thoughtfully considered. The following lines of procedure have been followed: (a) Forceful delivery alongside the tumor, mentioned first to be unqualifiedly condemned and thus disposed of; (b) reposition of the tumor, followed by spontaneous or operative delivery; (c) vaginal puncture or incision and evacuation of the cyst, succeeded by delivery from below, then removal of the sac; (d) vaginal ovariectomy; (e) abdominal ovariectomy, followed by delivery from below; (f) cesarean section, followed by extirpation of the tumor, with or without the uterus.

In all cases the first procedure is an attempt to dislodge and replace the tumor above the brim, out of the way of the advancing head. This is to be made in deep anesthesia, the patient lying in the exaggerated Trendelenburg or the Sims position (Fig. 557); the fetal head is to be pushed upward, and then, with the uttermost gentleness, using the whole hand, the tumor is disengaged from the pelvis. If the manoeuvre is successful, the child is delivered by version and extraction or forceps, or the case left to nature, depending on the conditions present. After the delivery of the child immediate laparotomy is performed and the tumor extirpated. It is best not to wait to remove the cyst, because the latter may have been ruptured or injured by the manipulations or delivery, and delay might mean fatal peritonitis.

If the case is a "clean" one, that is, not infected, and without previous interference or prolonged labor, and a single attempt at reposition fails, laparotomy is to be performed, the tumor removed, and then delivery accomplished from below. A long abdominal incision is necessary; the uterus may have to be turned out of the belly, and an assistant may have to dislodge the tumor from below before the mass becomes accessible. After the tumor is removed, if the uterus cannot be replaced in the belly (rare), it may be covered with hot towels, delivery effected from below, and then it will be easy to replace. Extensive adhesions, impaction of the tumor under the promontory, and solid and malignant neoplasms may

render such a course impossible, as in one of my cases, and the uterus may have to be emptied in order to reach the pelvis. In all cases a consistent attempt is to be made to remove the tumor whole, because the contents, especially if dermoid, are likely to be infectious. Should such an infected mass burst into the free peritoneal cavity, the uterus is to be also extirpated and vaginal drainage established. In determining whether a cyst is infected or not, in addition to the appearance, pus, ichor, and the odor, the history of inflammatory attacks is important. A tumor firmly attached to the rectum or colon is frequently infected, and unusual care is to be observed in removing it.

Suspicious or infected cases are best attacked through the vagina—indeed, Dührssen, Wertheim, and most German authorities recommend this way as the rule for all cases. Spencer, Kerr, Hofmeier, Williams, and most English and American authors advise the abdominal route.

*Vaginal Ovariectomy.*—A long, preferably longitudinal incision is made over the most prominent part of the tumor, the cyst grasped with vulsellum forceps, its contents evacuated through a broad incision, accessory cavities explored and emptied with the finger, and the sac then drawn down and its pedicle ligated. Should the pedicle be inaccessible, or should the head enter the pelvis upon the cyst being emptied, the sac is fixed to the vaginal opening by a strong suture, or the opening lightly packed with gauze and delivery effected, after which the tumor becomes easily manageable through the vaginal incision and should be extirpated. It has happened that laparotomy became necessary during the vaginal operation, because the pedicle could not be ligated, or the tumor was so brittle that it could not be pulled down, or the ligature slipped, or the tumor was solid or too densely adherent.

What should the general practitioner do in the home, far from help? In the presence of an urgent indication for delivery, the cyst is to be punctured, after opening Douglas' pouch, the sac emptied, anchored to the vaginal wall by a suture or light gauze packing, and labor completed. The sac is to be extirpated within twenty-four hours.

In the puerperium ovariectomy is to be performed in all cases, and preferably within twenty-four hours. If operation is postponed, a minute watch is kept for the first symptoms of infection of the tumor or torsion of its pedicle.

*Other Tumors Complicating Pregnancy.*—Reference, only, may be made to those rare conditions which the obstetrician may meet. They are all treated on general principles. Enlarged and prolapsed kidneys, usually the left (Bland-Sutton) (Cragin, vaginal nephrectomy); extra-uterine pregnancy combined with intra-uterine (Zinke); echinococcus cysts (Franta); parametritic abscesses and infiltrates; cancer of the rectum (Möhoff, 26 cases); rectal stricture; tumors of the bladder; vesical calculi, requiring lithotomy; bony tumors and enchondromata, to be considered later.

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## MINOR DISTURBANCES OF PREGNANCY

THE accoucheur is often consulted about annoying, if not dangerous, symptoms during pregnancy, and it is wise to instruct the gravida to report such phenomena to him, since he may detect in them the beginning of serious illness. Most of the troubles have been considered in chapters appropriate to them; here will be mentioned only those not previously treated.

**Insomnia** is rare, and is usually due to digestive disturbances and neurotic tendencies. The same may be said of constant dreaming. If regulation of the diet and bowels does not suffice, simple remedies often will; for example, one or two glasses of hot malted milk just before bedtime; a hot-water bag at the feet; sleeping alone, with a superabundance of fresh air; suggestion, by means of electricity, drugs, warm or medicated baths, an electric vibrator to the back of the neck, etc. Only rarely is a dose of sodium bromid necessary, and a few drams of elixir of chloral-amid or 5 grains of veronal may be used as succedanea—never morphin. If associated with high blood-pressure, look for toxemia.

**Sleepiness** is a frequent symptom of early pregnancy and requires no treatment. Late in gestation it is always to be regarded with suspicion, as it may pre-  
age the advent of eclampsia. Mental dulness may mean the same.

**Numbness and tingling** of the hands and feet, usually combined with slight puffiness, not real edema, are the evidences of a mild neuritis, perhaps toxic in origin. Occasionally local anesthesia and tenderness of the corresponding nerves are discovered. While the symptom rarely has any disturbing sequels, it should be watched. Treatment is on the theory that it is due to toxemia. Neuralgias have already been considered. Symptoms of real tetany seldom appear, though the women oftener complain of cramps and spasms in the arms and legs.

**Pain in the abdomen** is frequently complained of. In the early months a careful bimanual examination is demanded to exclude ectopic gestation. Pain is a symptom of many conditions which have already been considered—appendicitis, ureteritis, cholelithiasis, adhesions, etc. Intercostal neuralgia is rare, the pain in the lower ribs from which so many women suffer being most often due to dragging on the thoracic cage by the recti muscles, which carry the weight of the large uterus. An abdominal supporter is indicated. Rheumatic pains also occur, and relief may be obtained from the use of a liniment, for example:

R.	Ol. gaultheriæ,	
	Ol. camphoratiæ.....	āā 30 c.c.
	Lin. saponis.....	q. s. ad 120 c.c.

Most often the pain is due to constipation, with intestinal colic and flatulence. Pain associated with immense vulvar varicosities may be due to a similar condition of the broad ligaments. An abdominal binder and the occasional assumption of the knee-chest position will bring relief. Pain over the pubis and in the lower back, attended with difficulty of locomotion, is often due to softening and relaxation of the pelvic joints. Relief may be given by a tight strap about the pelvis, worn over the corset. Backache and abdominal pains are often due to faulty shoes or sunken arches. An orthopedic study of the case will aid in treatment. Stretching of the skin and the formation of striæ gravidarum are sometimes painful. Relief may be obtained from lubricants, such as solid albolene, cocoa-butter, or rose-water ointment.

## CHAPTER XLIV

### DISEASES OF THE OVUM

UNDER this heading will be considered, necessarily briefly, the diseases of the fetus, teratology, the pathology of the fetal adnexæ, the chorion, the amnion, and the umbilical cord.

**The Fetus.**—To J. W. Ballantyne is due the credit of having assembled our knowledge of the affections of the unborn child, and having really created a department of medicine—antenatal pathology.

Most of the acute infectious diseases of the mother have been demonstrated in the child, as has already been shown. Chronic infectious diseases, tuberculosis, and syphilis, the former rarely, the latter usually, pass over also. The fetus may become diabetic or toxic from its mother, though leukemia has not yet been proved to affect it. Icterus of the mother sometimes does and sometimes does not color the child. Icterus from toxic causes is very fatal to the fetus. Opium, alcohol, chloroform, ether, the iodids, methylene-blue, etc., pass over and affect the child. Methylene-blue given to the mother in the last week of pregnancy may be demonstrated in the urine and feces of the new-born for three days after birth. Most antitoxins go to the child through the placenta. Outside of these transmitted affections, the fetus has a pathology of its own. It will be impossible to do more than mention the best known maladies.

1. General fetal dropsy; fetal erythroblastosis (Kernicterus); cystic elephantiasis; congenital elephantiasis.

2. Congenital microcephalus, usually with idiocy; infantile spinal paralysis (Little's disease); chorea, Friedreich's ataxia, and other diseases of the nerves.

3. Ichthyosis, mild and severe; hypertrichosis; congenital absence of patches of skin, due probably to amniotic adhesions.

4. Diseases of the bones, which may be grouped under the general term "chondrodystrophia foetalis," but are otherwise hardly to be classified. Some cases resemble rachitis; some show bone aplasia, hypoplasia, or irregular hyperplasia.

5. Abdominal affections: peritonitis, ascites (which may be a cause of serious dystocia), congenital stenosis of the bile-ducts, hypertrophic stenosis of the pylorus, and neoplasms of the liver.

6. Nephritis; congenital cystic kidneys (which show a familial tendency and may be so large as to cause obstruction to delivery); dilatation of the bladder, with hypertrophy.

7. Circulatory diseases: endocarditis, atheroma, goiter.

8. Congenital cataract, iritis, etc.

9. Congenital uterine prolapse and injuries to the child from without.

A minute study of these conditions would be well repaid, and probably would lead to the discovery of valuable remedies for the antenatal treatment of the diseases,



FIG. 459. —ACHONDROPLASTIC FETUS (author's specimen).

or at least a recognition of some of the causes and the means of obviating their action.

**The Death of the Mother.**—Since the dying mother takes oxygen from the fetus, the death of the latter usually occurs first. If the mother dies suddenly, the child may live for a variable period. Brotherton reports a case where a living child was extracted twenty-three minutes after the death of the mother, and Tarnier one where the child lived twenty minutes after the death of its mother, who, while in the Maternité, was killed by a stray bullet during the Commune (Polk).

Rigor mortis may occur in utero (Fig. 460), and probably is common, though rarely observed and still more rarely published. It affects fetuses of all ages, be-



FIG. 460.—RIGOR MORTIS IN UTERO.

Child died as the result of pressure and prolonged delay during molding through a masculine pelvis. Delivery of the dead infant very laborious because of its rigidity.

gins from a few minutes to as late as five hours after fetal death, may be total or partial, and may cause difficulty in delivery. Its pathology is identical with that of rigor mortis of the adult and is due to the presence of lactic acid and colloid inhibition of the muscular fibers (Meigs). Curiously, the heart may beat a few times even after rigidity of the body has developed. Rigor mortis is found more frequently in cases of prolonged labor, eclampsia, hemorrhage, and slow asphyxia. It is not a sign that the child was delivered alive—a point of extreme importance in medicolegal cases. (See Paddock, Wolff.)

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## CHAPTER XLV

### TERATOLOGY

For details of this subject the reader is referred to works on pathology. Only the barest outlines of classification and a few principles of treatment can here be given. (See Birnbaum, Schwalbe.)

**Classification.**—Congenital deformities are not rare. A child born with a deformity so marked that it interferes with the general or local development of the body is called a monster. Monsters often die in the early formative stage, which may be proved by an inspection of aborted ova, and, if delivered alive, they usually succumb within a few hours or days, being incapable of extra-uterine existence. The frequency of monsters in aborted ova is noteworthy.

Of monsters there are two classes—single and double. We distinguish three general varieties of single monsters (Gurlt):

1. *Monstra per defectum*—where all or part of an organ is missing.
2. *Monstra per fabricam alienam*—where an organ is wrongly formed or dislocated.
3. *Monstra per excessum*—where an organ is enlarged or duplicated.

**Causation.**—Recent experimental work has done much to clear up the causation of monstrosities, and it is quite certain that external agencies have much to do with their formation. Heredity has indubitable influence, since we see the same peculiarity in several generations or members of the family. Sometimes a generation is skipped, and the deformity reappears in the third—atavism. We do not yet understand these internal causes, and for want of a better term they are called germinal, since they are inherent in the ovum. That the sperma has some influence in the production of monstrosities is rendered plausible by the experiments of Bardeen, who saw deformed ova result from fertilization by the sperma of toads which had been exposed to the x-ray, and those of Arlitt and Wells, who proved that repeated small doses of alcohol given to white mice produced abnormal spermatozoids and finally sterility.

Of external causes may be mentioned injury to the abdomen or uterus, short of the actual destruction of the fetus or ovulum; diseases of the uterus, perhaps hemorrhage; diseases of the chorion (Mall) and of the amnion; abnormal implantation of the ovum, for example, in the tube (Mall); arrest of development, and changes in the ovum during the blastula or morula stages, the result of thermic, chemical, or other physical action. It has been proved that lithium, sodium, potassium, and magnesium have a special selective action on the various cells of the morula, and produce characteristic monsters, some of the poisons affecting the nervous system and others the heart. Stockard and Lewis produced 50 per cent. of cyclopean monsters from the eggs of the common minnow by treating them with solutions of magnesium chlorid. Hertwig suggests that perhaps chemical poisons circulating in the maternal blood may affect the young embryo and cause monsters, a theory which the author has held for many years and which seems to gain some proof from the experiments of Werber. Nowadays few practitioners and none of the scientists believe the old notion that the mental state of the mother has a direct influence on the development of the child, but many careful observers are convinced that shock, worry, deprivation, etc., may produce vascular and nutritional disturbances, general and local, in the endometrium, which may seriously affect the growth of the ovum, a position which the author has long held,

and Ballantyne, one of our most authoritative teratologists, also holds.

Amniotic adhesions, formerly held responsible for many of the single monsters, Mall believes to be usually secondary, rather than primary. The author recently found a large staphylococcus in the fetal portion of the placenta from an anencephalic monster, with polyhydramnion. The role of syphilis in the production of monsters must again be emphasized.

**Single Monsters.**—1. *Monstra Per Defectum*.—The most common of single monsters are due to absence of closure of the medullary canal, which may be due to primary agenesis or aplasia of the medullary canal, to early hydrocephalus or hydrorachis, or to adhesion of the delicate, newly formed medullary canal to the amnion. The deformities resulting from this are grouped under the name "craniorachischisis." The splitting may be partial, either involving only the cerebral vertebræ, when we have cranioschisis, or only the spine—rachischisis. If all the structures covering the medullary canal are missing, the back presents a smooth, shining groove, with or without traces of brain or spinal cord (Figs. 461 and 462). If only the bony arch is missing, we have a meningocele, or hernia cerebri, hernia spinalis, or spina bifida.

When there is a mass of brain, more or less large, we call the condition *acrania*; when all the brain is missing, *anencephalus*. If the cranium is closed but smaller than normal, it is called *microcephalus*.

Irregularities in the closing of the branchial clefts produce deformities about the face and neck, the simplest of which are harelip, and the severest may show absence of large parts of the face.

The anomalies resulting from deficiency of closure of the lateral plates of the body walls are hernia umbilicalis, hernia abdominalis, ectopia vesicæ, ectopia cordis, etc. These are grouped under the name "thoracogastroschisis."

The splitting may go so far as to involve the intestine, showing that the two layers of the celom failed to fuse. Absence of fusion of the lateral halves of the genital and urinary organs produces deformities here of utmost variety. Hypospadias is the mildest and most common, ectopia vesicæ with split pelvis more marked deformity.

Agenesis of the extremities, fusion of the extremities or of fingers and toes, and deformities due to amniotic bands occur, but are rare. If the anterior cerebral vesicle does not divide, we have a cyclops developed, or a *cyclocephalus*. Cyclops monsters are among the easiest to produce artificially (Fig. 464).

2. *Monstra per fabricam alienam* are mainly cases of situs inversus viscerum, abnormal position of the kidneys, testicle, colon, and sometimes of the joints, and congenital luxations and deformities. These latter are not seldom in the first class.

3. *Monstra Per Excessum*.—Increase in the number of a part or organ and increase in the size of same.

**Double Monsters.**—*Monstra duplica* come from one ovum, and are developed from one germinal vesicle. Two germinal spots, two primitive streaks, or two medullary grooves may be formed, or, later in growth, a duplication of one or the other end of the germinating zone takes place. Experiments have shown that double monsters can be produced in the blastula stage by separating the blastomeres, which is accomplished mechanically or chemically. If two embryonal areas appear, it is possible that two complete individuals (homologous twins), or, if the two areas are not entirely separated, united twins, will result. If the two areas are unequal in size, one of the individuals is stunted and attached as a parasite to the other, or may be included in the other. The etiology of such monstrous formations is unknown. Entrance of more than one spermatozoid into the ovum is not the cause, because eggs so impregnated usually die. Kohlbrügge has shown that in some animals the accessory spermatozooids supply food for the germinating ovum. Whether there is a splitting of one primitive streak or the fusion of two primarily developed is unknown—probably fission occurs. Double monsters are thus classified (Foerster).

**Terata Katadidyma.**—In these beings the fission or doubling is from the head downward, in the most fully developed specimens there being one pelvis and two trunks, the trunks being separate (Figs. 465–469).

**Terata Anadidyma.**—Here the splitting is from below upward, all grades being served to the last, where the two complete bodies are attached at the head (Figs. 470–473).

**Terata Kala-anadidyma**, the fission being from both above and below. The bond of union may be very broad, extending up and down the whole venter or dorsum of the two children, or very small, the point of attachment being at the



Fig. 465.



Fig. 466.



Fig. 467.

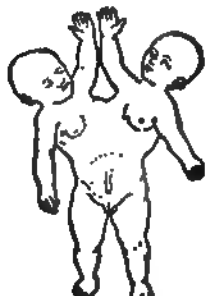


Fig. 468.



Fig. 469.

FIGS. 465-469. — SUCCESSIVE DEGREES OF FUSION IN TERATA KATA-DIDYMA.



Fig. 470.



Fig. 471.



Fig. 472.



Fig. 473.

FIGS. 470-473. — SUCCESSIVE DEGREES OF FUSION IN TERATA ANADIDYMA.

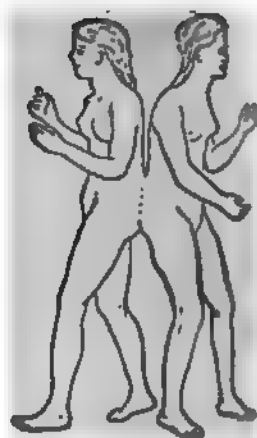


Fig. 474. — Pygopagus — Black twin.



Fig. 475. — Thoracopagus — Same "



Fig. 476. — Johnson twins.

FIGS. 474-476. — TERATA KATA-ANIDYMA.

All these sketches are copied exactly from Ahlfeld's "Atlas."

rum, the abdomen, or the sacrum. Rotation may bring the two bodies into line, as in the Johnson twins from Wisconsin (Figs. 474-476).

Homologous twins are the best examples of the last class, since in these the union of the two streaks was complete. If the development of the two individuals is equal, two well-formed children result; if one is stronger than the other, its heart becomes that of the other, which later shrinks up into an acardiacus. Depending on the original distribution of embryonal cells, one or the other portion of a fetus will be represented in the acardiacus, the head, the trunk, or the lower extremities (Figs. 477 and 478). Sometimes all or a part of a primitive streak develops inside another embryonal area, and thus *inclusio foetalis* and *teratomata* result.

Homologous portions of the two individuals are almost always united, and we name the monster after the location of the union; for example, when it is at the navel, *sternopagus*; the ensiform appendix, *xiphopagus* (Siamese twins); at the navel, *pygopagus* (the Bohemian sisters); at the head, *craniopagus*, etc.

**The Clinical Aspects of Monsters.**—Since single monsters are more common



FIG. 477.—ACARDIACUS ACEPHALUS.



FIG. 478.—ACARDIACUS ACORNUTUS (Ahlfeld).

in double, they present greater interest to the accoucheur, and, further, they induce dystocia more frequently because they more often develop to maturity and because enlargement of the parts is so often met. Hydrocephalus, anencephalus, broad shoulders, hernias, and accumulation of fluid in the body cavities are usual conditions found, but they present simple problems of treatment. Double monsters, curiously enough, are frequently expelled spontaneously, but when they give rise to dystocia, dangerous and most complicated operations are often needed to effect delivery.

**Diagnosis.**—Even before labor one may suspect the existence of an abnormally sized child. Hydrocephalus could be diagnosed, and an acephalous monster too, if the examiner were on the alert. A woman who had delivered one of the latter was much relieved when, at the seventh month of a subsequent pregnancy, it was

possible to assure her that the fetus had a large, well-formed head. Under the same circumstances the absence of a cranium would as easily have been determinable. The x-ray is now available. Since recurrence of monstrous children is not rare, the history is of service in the diagnosis.

During labor the possibility of a monstrous formation is to be considered, with other things, when the internal examination reveals atypical findings. Before attempting cesarean section it is wise to consider the shape of the child, as well as its size and viability, for it might be humiliating to deliver a monster by this serious operation. It has happened to clever accoucheurs.

An anencephalic monster, as shown in Fig. 462, presenting by the head, might easily cause confusion with placenta prævia, prolapse of the cord, simple face presentation, or breech presentation. The frequent association of deformities will help in diagnosis; for example, when in a breech delivery a spina bifida is found, hydrocephalus may be expected, or if the delivered head shows harelip and delay in delivery of the trunk ensues, one should think of a monster, single or double. Polyhydramnion is so frequently present with fetal anomalies that one should always look for the latter when it exists.

Double monsters have never been diagnosed before labor; at most, twins have been suspected. Two bags of waters exclude a double monster. The rule has been that only after labor stopped was the obstruction recognized to be due to joined fetuses, but inspection of the part delivered may give a hint as to the cause of the delay, for example, harelip or atresia ani (Lyll). If delay in delivery, not overcome by the usual manipulations, should occur, an examination with the half hand or, if necessary, with the whole hand, is to be made. For the sake of deliberation and thoroughness an anesthetic had best be given, and in primiparæ a deep episiotomy is advisable. Such an exploration must decide the presence of enlargement of a part of the fetus, a tumor of the uterus or the fetus, a double monster, and, if the last, the location and extent of the area of fusion, the number of arms and legs, and the movability of one child on the other.

**Treatment.—Prevention.**—Can anything be done to prevent a recurrence of the delivery of a monster? Syphilis can be treated; if the uterus is diseased (e. g., endometritis), one may try to cure it. In two instances where this question was put to me, the patients having had anencephalous monsters before, I prescribed a hygienic life for both parents before the impregnating coitus, quiet for the mother in the early months, and a pill, to be taken throughout pregnancy, containing carbonate of iron, gr. 3; hydrargyri iodidi rubri, gr.  $\frac{1}{10}$ ; arsenous acid, gr.  $\frac{1}{30}$ ; t. i. d. Both women had healthy children. One patient also received calcium lactate.

Nature helps in the delivery of monsters by interrupting the pregnancy while the fetuses are still small, but cases are on record of united twins weighing 15 and 17½ pounds, causing formidable dystocia. In general, breech presentation is most favorable for all monstrosities, and if duplicate, it is best if all three or four legs are accessible. Single monsters with enlargement of parts are to be reduced in size; a hydrocephalus is punctured (never forceps); a full abdomen is emptied, etc., and if delivery is indicated, version and extraction are preferable. No consideration is to be shown either a single or a double monster when the mother's life is in danger. Since the necessary mortality in labor and afterward is enormous, all our efforts should be directed to saving the mother. Experience has shown that it is best to deliver the children whole, and not to amputate a head or trunk which has been expelled. It may be necessary to amputate the delivered portion in order to gain access to the rest or to render the balance of the mass movable, but such occasions are rare. Tremities should not be removed, because they do not interfere with our manipulations; further, they provide a grasp on the locked-in fetuses, and, thirdly, their removal destroys the relations of twin to the other and adds complications in the diagnosis and treatment. Cesarean section is necessary if attempts at delivery from below fail, but it has very rarely been done—indeed, patients, when they come to this point, are the poorest possible subjects for abdominal delivery. Contracted pelvis, as a complication, would, of course, indicate it, and, too, if a double monster were recognized at a time when an abdominal operation could be performed under ideal conditions—an occurrence not yet on record.

For clinical purposes the various double monsters may be divided into three forms, as (Veit):

Those which offer obstacle to delivery by the increase of the size of the body at one or end; for example, diprosopus, cephalothoracopagus, dipygus parasiticus—such as an . . . Most of these monsters belong to the classes terata anadidyma and terata katadidyma (465 to 473).

Some monsters where fusion is at one or the other end, the two having a tendency to the trunk—ischiopagus, pygopagus, craniopagus.

3. Where the monsters are well formed and have freedom of motion at the point of fusion, amplexus, thoracopagus, xiphopagus, or where there are two or three heads, well developed, on trunk.

In the first class, if the two heads present and engage, one after the other is delivered by version; if not engaged, version is performed, then exenteration and craniotomy in succession, if necessary. If one head is delivered and the shoulders do not come, the delivered head may have amputation, by which access is gained to the double trunk. The second head is led into the trunk, delivered, and then the double trunk reduced in size by cleidotomy and exenteration. If duplicity is caudal, all four extremities are to be delivered at one time, and evisceration of trunk performed, after which the extraction of the common shoulders and head is performed.

The second class of monsters, united by the head or breech, seldom causes trouble, the sausage-shaped trunk slipping through with no difficulty. Root and Bartlett, of Chicago, delivered an ischiopagus, bent like the letter U, with the two fused breeches presenting. The junction was severed and delivery quickly effected, one fetus at a time.

Of the third class of cases, the Siamese twins are a good example. One of these was delivered by the head, the other by the breech. The connecting band may be so elastic as to allow separation of the second twin after the delivery of the first. It is fortunate if the two children present by the breech, and the posterior one should be delivered first, then the anterior child. If the bond of union is firmer, by unequal traction the head of the posterior fetus is to be drawn into the trunk of the anterior and both delivered together. Exenteration will be done or the bond of union divided whenever necessary. If one child presenting by the head is delivered to the trunk and stops, the other may be turned by the breech and the two then delivered side by side. If both heads present and neither engages, version on both twins is performed.

As a rule, the operator is not required to hurry, but may proceed with calmness and deliberation. He should study carefully the kind of monster he has to deal with, its size, the shape and position of the pelvis, etc., and have the proposed procedures completely worked out before operating. Overgrowth of the child will be considered under the Pathology of Labor.

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## CHAPTER XLVI

### DISEASES OF THE FETAL ENVELOPS

#### THE CHORION

CLINICALLY, myxoma diffusum and fibrosum, which pathologists describe, are of little importance, but vesicular degeneration of the chorion is not uncommon, and requires the earnest attention of the accoucheur. Hydatidiform or vesicular degeneration of the chorion, vesicular mole, or grape-mole, is due to a proliferation and degeneration, with edema, of the stroma of the chorionic villi and increase of the syncytium. (See Caturani, Turazza.)

Kossman showed that Hippocrates knew of this condition, and ascribed it to a morbid degeneration of the villi, a theory which Virchow propounded and which was generally accepted until the minute and convincing work of Marchand and Fritsch was published. Aëtius of Amida, in the sixth century, described it, and Vega, in 1564, and Vallersa, in Turin, in 1573, reported typical cases. The latter believed the disease to be due to abnormal development of the, at that time, described "female semen." The vesicles were considered "bladder worms," "pseudobelminths," or *Acephalocystis racemosa* (Ciquet, 1822). Velpeau (1827) called the cysts degenerated villi, as we now know them to be; Meckel (1847) showed the hyperplasia of the connective tissue with edema, and Virchow (1853) called it a sarcoïd or myxomatous degeneration.



FIG. 479.—HYDATIDIFORM MOLE (AUTHOR'S SPECIMEN).

A hydatidiform mole cannot be mistaken (Fig. 479). It resembles a bunch of Catawba grapes of irregular size, varying in size from that of a pin-head to that of a hen's egg (rare),

usually the size of a pea or bean. A loose mass of thick decidua, and cheesy material with blood-clots interspersed with these bladder-like bodies, is usually expelled, but the specimen may be a compact, egg-shaped cast of the uterus and filled with vesicles. In these cases the growth had ceased some time before expulsion. The vesicles hang to parent stems and to each other (Fig. 480). Usually, all traces of fetus and amnion have disappeared, but cases are on record in which both have been preserved, and then the mass may be expelled entire and be recognized by decidua. All the chorion may be changed, which is the usual finding, and it is not that the degeneration began early in gestation, but either the chorion from the placenta or the chorion laeve may be alone affected. Even parts of the placenta may be affected and a living child may be born, or only one ovum of a twin pregnancy may be affected, as in the case of the famous anatomist, Béchard, whose mother, at the fifth month of gestation, expelled hydatids (Parvin). The case of Depaul is similar. Ectopic gestation may undergo this form of degeneration. It is an

whether the degeneration precedes the death of the child or follows it—both occur. The author has frequently found, in aborted ova, one or degenerated and forming vesicles.

Microscopically, the stroma of the villi is hyperplastic, and has become edematous and necrotic, so that only at the periphery of the vesicles can the fibrillary and cells be distinguished (Fig. 481). Very few vessels can be found, and are empty. Particularly marked is the proliferation of Langhans' layer, which invades the syncytium and grow into the intervillous spaces. Its cells are degenerated and degenerated, staining badly. The syncytium also hypertrophies and undergoes necrosis, it, as well as Langhans' layer, showing numerous vacuoles. It may be so marked that the syncytium may grow through the decidua and uterine musculature. Even the vesicles may burrow into the veins and through the muscle-fibers, sometimes as far as into the peritoneal cavity, causing hemorrhage and peritoneal hemorrhage. If the chorionic wall is honey-combed by the advent of the proliferating villi, it is during the process of abortion, lacerated by the finger or instruments, the patient may die of external hemorrhage, and the diseased uterus cannot be removed properly. These forms are called moles, and clinically are much

attention is to be made of those hydatidiform moles which even-chorio-epithelioma or malignant syncytioma. Meckel, before 1795, recorded an amniotic mole which resulted in the death by metastases of a tumor of the uterus, and recently it has been found that a history of cystic mole is present in over half of the cases of syncytioma which come to treatment. Syncytioma may develop in the cervix, or in the vagina (local), or, if the vesicles and masses of chorion are carried by the blood-stream to other organs, a general syncytiomatosis but usually the lungs are first and then the liver. Local and general metastases

while the grape-mole is still in the uterus. Since so many cases of chorio-epithelioma malignum give a history of mole, one might think that hydatidiform degeneration of the chorion was very frequently the cause, but it must be remembered that grape-mole is not very infrequent, and that syncytioma will almost always be published, while the mole, being more common, is not. For example, the author had 16 cases of vesicular moles published, and none, as far as known, has developed metastases. König's 13, and Kehrer's 50, followed up, did not develop chorio-epithelioma. Finally, it is impossible to determine when a given mole will become malign-



FIG. 480.—DETAIL OF HYDATIDIFORM MOLE.

cystic degeneration of the ovaries has, in a large proportion of cases, been coincident with this condition, an observation made by de Gregorini in 1795. The ovaries may be changed into tumors as large as a fist, composed of immensely dilated and sometimes edematous ovarian stroma, full of cysts which vary in



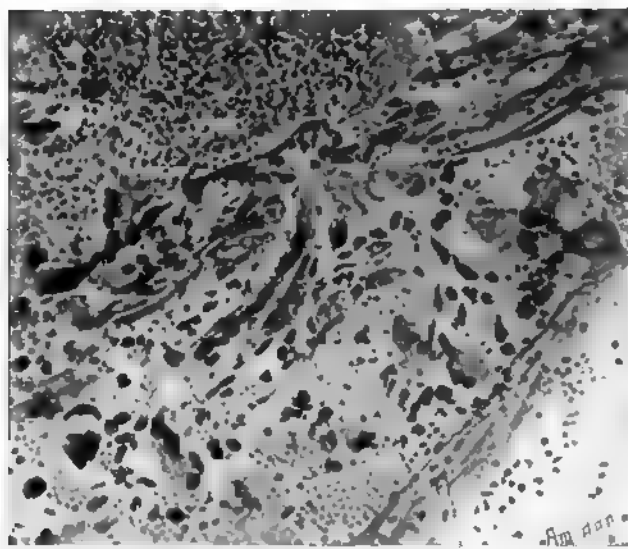
Combining the statistics of Dorland and Gerson, Hirtzman, and Williamson, we find a maternal mortality of 19 per cent. One of my 16 cases died from acute sepsis. The dangers are uncontrollable hemorrhage, perforation of the uterus (spontaneous and instrumental), infection, which is quite common, and the development of syncytioma malignum.

**Treatment.**—As soon as the diagnosis is made the uterus must be emptied. Dilatation of the cervix sufficient to admit two fingers is necessary, and should be obtained by cervical tamponade with gauze or a small colpeurynter. (See Chapter LXIX.) A firm vaginal pack of sterile cotton should be inserted as a safeguard against hemorrhage while the os is being dilated. At the time of operation all preparations should have been made for hemorrhage and the treatment of anemia. Curets and placenta forceps should never be used because of the danger of perforating the uterus whose walls may have been weakened by a destructive growth. Even the fingers may perforate the thinned uterus, all of which should warn to caution, yet every safe effort is to be made to remove all the masses, thus to eliminate the danger of the development of a neoplasm and of sepsis. As in placenta prævia, blood must

be spared at every move and the uterus firmly tamponed if it shows a tendency to relax and bleed. Findley advises curetment after several weeks to assure the cure, but this is seldom feasible. Certainly the woman is to be kept under close observation for two years, and the uterus removed if signs of a malignant tumor develop in it.

#### Chorio-epithelioma.

—Sänger, in 1889, described the case of a woman who died from metastatic tumors seven months after an abortion. The large cells found he thought, were decidua, and he, therefore, called the tumor sarcoma de-



Wall of vein

FIG. 482. CHORIO-EPITHELIOMA.—MASS OF SYNCYTIIUM IN A VEIN.

ciduocellulare. Since then over 300 cases have been reported, and a mass of literature on the subject has accumulated. Only recently have our ideas regarding the nature of the affection crystallized, and the confusion which existed may be appreciated after a glance at the names which have been suggested for it—sarcoma deciduocellulare, carcinoma syncytiale, deciduoma malignum, blastoma-decidua-chorion-cellulare, syncytioma malignum, invasive placental polyp, chorion epithelioma. Marchand's views of the nature of the tumor are now generally accepted, and the name Fränkel and Pick proposed, chorio-epithelioma, is the one most employed. Frankel first called attention to the chorio-epithelial nature of the growth. (See Veit, Frank, Ewing.)

Chorio-epithelioma is a tumor developed from the fetal ectoderm, which may begin during pregnancy (normal or abnormal) or after the uterus is emptied, and which is characterized by exuberant growth, early and extensive local and general metastases, and rapid cachexia, often combined with sepsis.

Its causation is unknown. We know that syncytium has invasive power, that

the villi erode their way into the uterine wall, into the blood-vessels, but what keeps this power in normal limits and what permits the growth of the cells to pass all bounds cannot even be conjectured. Hydatidiform mole preceded the development of this disease in over half of the cases, which shows that some connection exists between the two.

*Pathology.*—The growth begins at the placental site and protrudes into the uterus as a very vascular, soft, purplish mass, usually sharply differentiated from the mucosa. It may grow through the uterine wall and make tumors which project into the peritoneal cavity or the broad ligaments. More often the veins are invaded, and thus general metastases brought about. Vaginal metastases—the

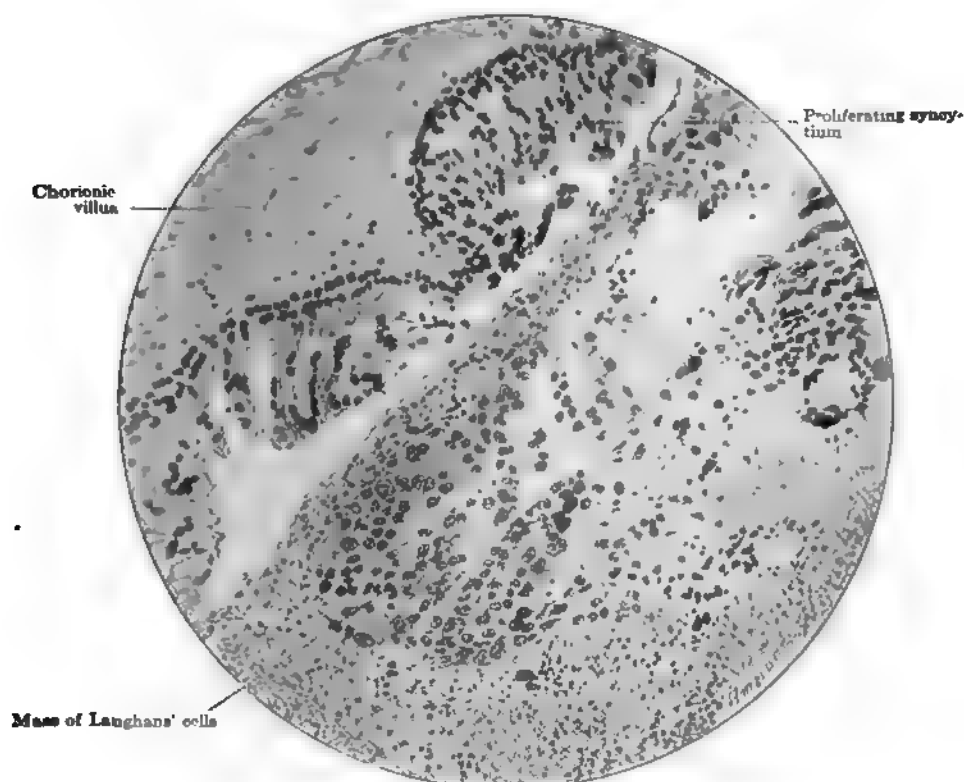


FIG. 483.—CHORIO-EPITHELIOMA.  
Shows extension of process in vein.

most frequent—are probably local, from surface implantation. In appearance such a nodule resembles a hematoma.

Microscopically, the tumor is made up of masses of syncytium and proliferated Langhans' cells, which often form blood-spaces, and even structures which resemble villi. Round-cells and polynuclear leukocytes abound; the whole tumor is very bloody. Masses of syncytium may be seen advancing in the veins, and if hydatidiform mole was present, hydropically degenerated villi may be found. Marchand distinguished an atypical and a typical variety, both equally pathogenic, but in the latter the tumor cells resembled exactly the chorionic cells of early pregnancy. The syncytium, with its large, irregularly shaped masses of protoplasm, with sharply staining nuclei, is especially well represented, but Langhans' cells are also present. In the atypical varieties, which more resemble sarcomata, there is a more diffuse infiltration of the tissue by closely packed, deeply staining, irregularly shaped cells, with large nuclei, which may form clumps resembling syncytium, and are probably

altered Langhans' cells (Fig. 483). Sometimes one kind of cells predominate and again the other. Combined forms exist. Lutein cysts of the ovaries develop in a large proportion of the cases of syncytioma, as in vesicular mole.

Curiously enough, malignant chorio-epithelioma with all its characteristics, even with structures resembling villi, has been found to arise from teratomata of the testicle. It probably originates from fetal ectoderm, included in the congenital teratoma.

*Clinical Course.*—After an abortion, especially of a vesicular mole, or after labor, the patient complains of irregular uterine hemorrhages. Usually a curetage is performed, but, since the masses thus obtained resemble placental tissue, a microscopic examination is often omitted. In half of the cases a vulvar or vaginal nodule first drew attention to the condition, and in my case the uterus enlarged enough to be felt by the patient. The growth may be found during pregnancy, before expulsion of the mole, as early as a week after delivery (Williams' case), but usually several months later, and in three cases, two, three and one-half, and four and one-half years after delivery (Krösing), at a time when the causal gestation had been almost forgotten. Repeated hemorrhages rapidly exhaust the woman, weakness and the symptoms of anemia become pronounced, pallor, subicterus, albuminuria, edema of the feet, and puffiness of the eyes, that is, the signs of cachexia,

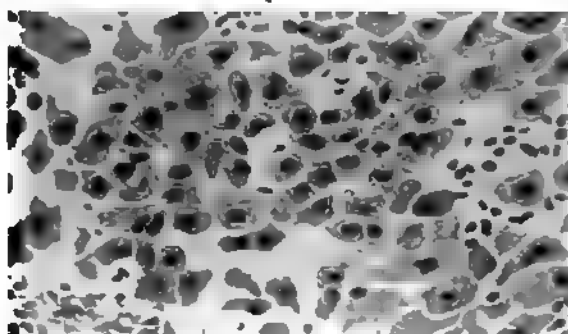


FIG. 484.—CHORIO-EPITHELIOMA.  
Mass of Langhans' cells resembling decidua.

supervene, and very often, since the tumor masses in the uterus possess such a tendency to necrosis, a vaginal discharge with gangrenous odor and general septicæmia with fever occur. Metastases in the lungs may be diagnosed when cough, bloody expectoration, and pulmonary findings are present. Examination of the sputum has thus far been negative. Metastases occur in the lungs, vagina, liver, spleen, and brain. Vaginal tumors may eat into the bladder, like cancer.

*Prognosis.*—Later writers distinguish a less malignant type of chorio-epithelioma, one that disappears spontaneously or after the removal of the vaginal metastases and uterine curetage. As a rule, however, unless early operation is performed, these patients die within a year after the first appearance of the neoplasm. This is the most rapidly destructive growth with which we have to deal.

Death occurs from intractable hemorrhage, cachexia, infection, septicæmia, and occasionally from hemorrhage into the peritoneal cavity or peritonitis, both the result of perforation of the uterus by the invading tumor.

*Diagnosis.*—Repeated hemorrhages after abortion are usually due to a placental polyp. Curetage is indicated, and the scrapings should be studied by a competent pathologist. Recurrence of a uterine growth after successful curetage for removal of the products of gestation is often due to chorio-epithelioma. A vaginal metastasis will usually, but not always, indicate the cause of the symptoms. Removal of part of the tumor and its microscopic study are essential for positive diagnosis, which an expert pathologist can readily make. At some point in the

section the characteristic syncytial formations will be found. In the differential diagnosis fibroids, other neoplasms, and pelvic exudates must be considered. Abderhalden found the pregnancy reaction in a woman twenty-seven years after her last delivery. A tumor removed from her uterus proved to be chorio-epithelioma (Findley).

**Treatment**—In view of the treacherous nature of the disease and its enormous mortality, radical extirpation of the uterus, adnexa, and accessible metastases is indicated. Since it is propagated along the veins, it is well to ligate the vessels as far outward as possible.

#### DISEASES OF THE PLACENTA

**Variations in Shape.**—Variations from the typical round shape of the placenta are common, and generally have no practical significance. (See p. 50.) These variations are due to irregularities in the nutritional conditions of the uterus. A placenta nested in the horn of the uterus is likely to be round and show a marginal ring. One near the os may encircle the orifice in a horseshoe form. One attached at the side of the uterus may spread on both anterior and posterior walls and be bilobate, etc. Without doubt the placenta may be bisected or trisected by white infarct formations, and I believe this is the commonest cause of irregular shapes.

**Placentæ and placentulæ succenturiatæ**, already mentioned, have great importance for they may be left in the uterus and give rise to hemorrhage and sepsis. They are supposed to be due to— (1) The development of some of the villi of the chorion læve; (2) to cutting off of a portion of the placenta by white infarcts; (3) to development of villi in the decidua vera with missing reflexa. **Placenta membranacea**, which is normal in the pachydermata, has, in excessively rare instances, been observed in the human—nearly the whole of the envelop of the egg was converted into thin, membranous placental-tissue. Moderate degrees, that is, extensive thin placentæ, are occasionally observed, but are usually due to infarct formation. The thickness of the placenta is in inverse proportion to its size.

Heart disease, nephritis, anemia, diseases of the uterus, favor abnormal development of the placenta, and also make pathologic changes in the uterine musculature, such as hyaline degeneration, which in turn causes atonia uteri, even rupture, etc.

**Infarcts.**—Nearly every placenta will show, on careful inspection, whitish, nodular, hard areas, occupying the fetal or maternal surface, or both, and varying

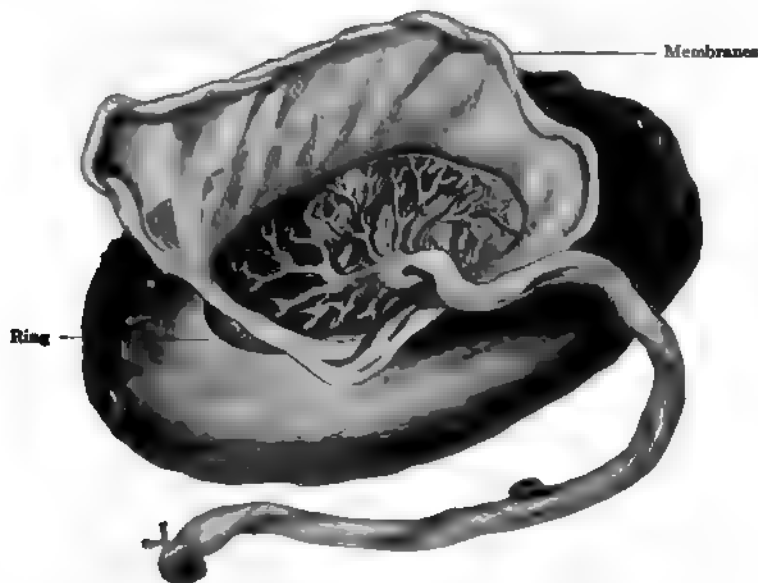


FIG. 485.—PLACENTA CIRCUMVALLATA (Northwestern University Medical School Museum).

in size from a pin-head to several centimeters. Other names for these formations are hepatization, scirrhous, placentitis, apoplexy, cirrhosis, and phthisis. These structures are called *infarcts*, and several varieties are found, having different causation, though little is positively known on this point. The different kinds will be considered in the order of their frequency.

1. At the edge of the placenta, at the site of the subchorial decidua, a more or less complete white ring is found, which varies in width from 2 to 16 mm., and in thickness from 1 to 4 mm. Sometimes the ring is raised from the surface and the attached membranes are doubled back over the edge of the placenta, as in Fig. 486. This is called *placenta circumvallata* or *nappiformis*. There are four views as to the manner of production of this anomaly—(a) The placenta is located in a tubal corner of the uterus, or over the internal os, and the area of the placental site grows more rapidly than the rest of the uterus, the latter constricting the former at their junction (Fig. 485). (b) Owing to inflammatory changes in the decidua, the closing ring of Waldeyer and the decidua subchorialis, whose nutrition is precarious, become necrotic, and temporarily hinder the splitting of the decidua and the growth



Fig. 486.

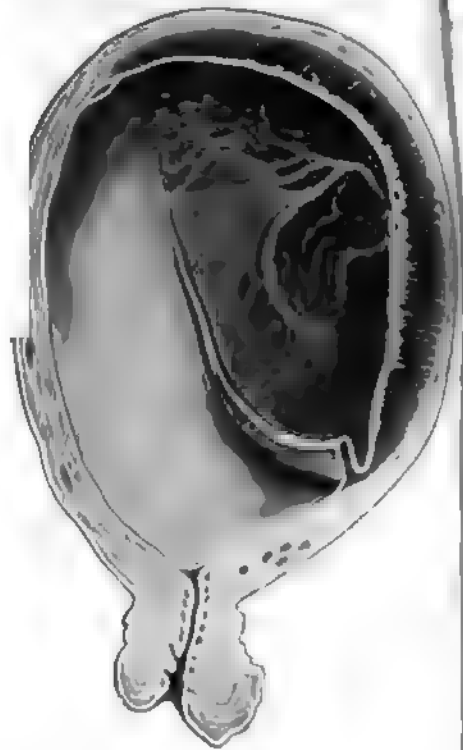


Fig. 487.

FIGS. 486 AND 487.—PLACENTA CIRCUMVALLATA IN FORMATION  
Shows development of the fold in membranes (from Bumm)

the placenta in this direction. (c) Endometritis causes early adhesion of the reflexa to the vera, and changes at the site of the closing ring of Waldeyer prevent the growth of the placenta in the marginal reflexa, the placenta, therefore, splitting the vera. We sometimes find that the cotyledons extend  $1\frac{1}{2}$  inches beyond the insertion of the membranes (v. Herff). (d) Hitschman believes that, as the result of a sudden diminution of the liquor amnii, the coverings of the ovum must shrink, and naturally there would be an infolding at the edge of the placenta (Figs. 486 and 487; unck, Sfameni).

*Placentæ marginatæ* and *circumvallatæ* have much clinical importance, because of the interest which attaches to the endometritis so often causative. Early in pregnancy smaller or larger hemorrhages sometimes occur, and abortion is not infrequent. Tubal corner placentas might be called a distinct clinical entity, causing

n, bleeding, abortion, premature labor, puny children, postpartum hemorrhage, and difficulties in diagnosis. (See Angular Pregnancy, p. 401.) In placenta mar-ata adhesion of the membranes is very common, and the placenta may be de-ered naked or decrowned of its membranes. As the result of this retention hemor-ige and sapremic fever sometimes ensue. Abnormal mechanism in the third ge, with retention or adhesion of the after-birth, requires the introduction of the nd in the uterus oftener than with normal placentas.

2. On the fetal surface of the placenta we find nodular infarcts, which vary in e from those scarcely visible to the eye, to 3 to 5 cm. across and up to 1 cm. thick. e smaller ones preponderate and may be bunched, or there may be a thin, nodu-layer of fibrin which covers a good part of the fetal surface.

3. Some infarcts take in the whole thickness of a cotyledon and may involve or more of them. In Fig. 488, which came from a nephritic, nearly one-half of placenta was involved in infarct formations in various stages of development.



FIG. 488.—PLACENTA FROM CASE OF SEVERE NEPHRITIS.  
On the left, masses of infarcts, on the right, an immense hemorrhage.

ch a condition may compromise the nutrition of the child, which is born weak and ny, or if, as often happens in Bright's disease, more than half of the area is involved, child will die. Such placentas are likely to be prematurely detached (abruptio), d Fig. 402 shows a hemorrhage causing a separation. This last form of infarct ars the most resemblance to the Cohnheim infarct; the other two can hardly be led thus, though Ackerman gave them the title "white infarcts."

In general there are three views as to their causation. Ackerman believed a ri-arteritis or endarteritis existed in the villi and produced obliteration of the vessel nen, with consecutive necrosis of the villus stroma, then of the villus wall, and con-quent clotting of the blood in the adjoining intervillous spaces. Steffek, von anquè, and many investigators believe that endometritis and decidual overgrowth d consequent necrosis of the villi with fibrin deposition are the cause. Primary eration or desquamation of the chorionic epithelium, which is not abnormal in the t weeks, causes deposition of fibrin and infarct formation, according to Hitschman. is probable that there is truth in all these theories, and that the first explains the

multiple infarcts on the fetal surface; the second, the infarcts on the maternal side, and placenta marginata; the third, the microscopic infarcts made up of necrotic ectodermal cells which are constantly found in ripe placentas. Perhaps the general vascular changes of nephritis are also present in the newly formed placental blood-vessels, and, through endarteritis, obliterate their lumen, causing infarcts and hemorrhages, and finally, the typical albuminuric placenta. May not these infarcts be one expression of a toxemia? The author in one case found a large staphylococcus in the infarct.

Microscopically, we find circumscribed areas of placental tissue which have undergone coagulation necrosis (Figs. 489 and 490). In the advanced stages the whole mass is changed into fibrin with only traces of the previously existing villi. Sometimes there are evidences of obliterating endarteritis and peri-arteritis, and

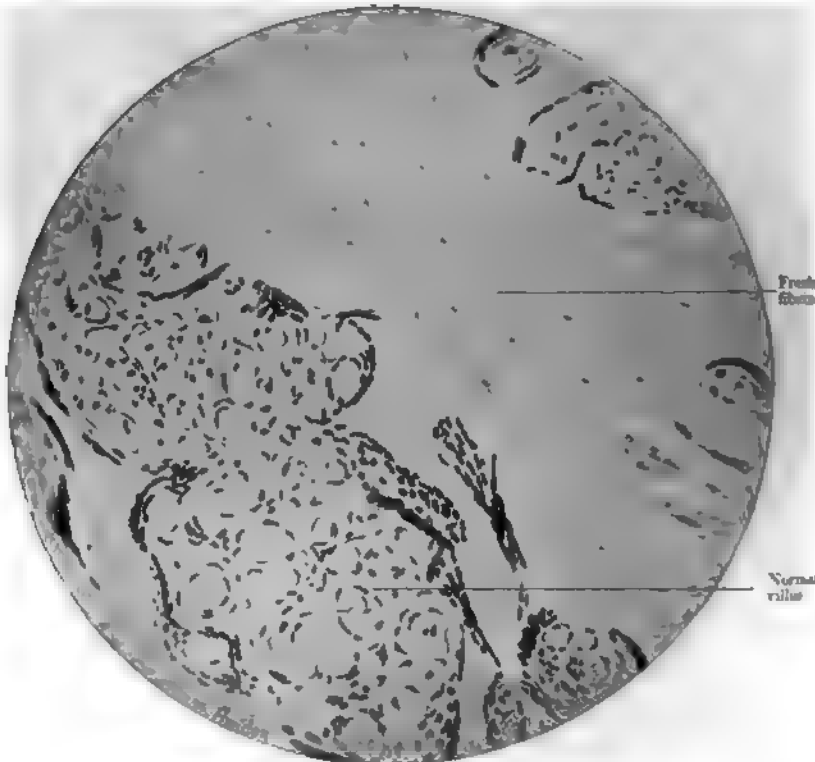


FIG. 489.—PLACENTAL INFARCT. YOUNG.

when endometritis existed, large numbers of decidual cells undergoing necrosis and even small-cell infiltration, which may affect the villi, will be found.

Clinically, infarcts cannot be diagnosed, but their existence can be expected in cases of nephritis, heart disease, syphilis, endometritis, and when they were present in previous pregnancies. Mention has been made of the fact that those infarcts which take in one or several cotyledons, may reduce the oxygenating area of the fetus, and also the nutritional functions of the placenta, so that the child is puny or even starved to death. Cognizance is taken of this fact in deciding on the induction of premature labor in nephritis. Extensive infarct formation is often associated with adherent membranes and the retention in the uterus of masses of thick decidua, which often give rise to annoying oozing after the third stage of labor, and even severe postpartum hemorrhage.

**Hemorrhages.**—No structure in the body possesses blood-vessels as friable as those of the decidua, and as a result hemorrhages are not rarely found in it. These

most always in the serotina, and produce a varying degree of separation of the ta. Sometimes they lie in the decidual septa between the cotyledons. (It is probable that these septa are of fetal origin.) In the latter instance they im-; intraplacental hemorrhages. It is not clear to the author how bleeding can lace into the intervillous spaces. They are blood sinuses and communicate with each other, so that a sudden increase of arterial pressure would be dis-; od to burst into the surrounding tissues. Another form of placental hemor-; omes from rupture of the marginal sinus, already referred to. must not be forgotten that a hemorrhage can occur in a red or white infarct. rhages have also been observed on both surfaces of the placenta. Organiza-; the clot occurs, and it is possible to trace the changes through the stages of—

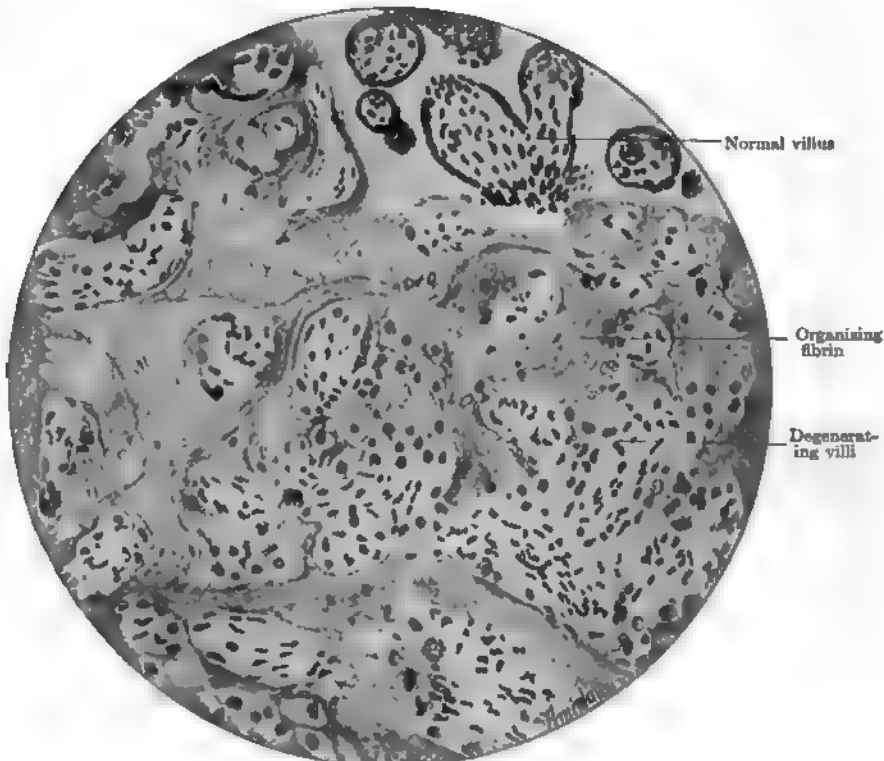


FIG. 400.—PLACENTAL INFARCT. ADVANCED.

ft, red-black clot; (2) brick-red, firmer mass; (3) fibrin formation in the ery, with some liquid content, to (4) through-and-through hard fibrous . These nodules resemble white infarcts.

he causes of these hemorrhages are acute and chronic congestion, increased pressure, stagnation of the venous blood-current, disease of the villi, of the al blood-vessels (endometritis), and the blood changes incident to Bright's ; toxemia, hemorrhagic diathesis, and syphilis. Physical or mental shock al injury also may cause them. I believe there is some relation between the a of pregnancy, hemorrhages in the decidua, even abruptio placenta, and the ilic conditions which arise during gestation.

inically, placental hemorrhages are of great importance. If they occur early nancy, abortion may result, and, perhaps, fetal monsters. Later, abruptio æ may ensue. Smaller clots may not be found until after delivery, but the



history of attacks of pain, slight external bleeding, and uterine contractions which subsided may serve to show the accoucheur that some disturbance of fetation had occurred at some time during pregnancy.

Rarely coagulation of the blood in the intervillous spaces takes place. Thrombosis of the sinuses of the placental site may be looked upon, in the later weeks, as a normal process, and preparatory to involution of the uterus. It has been found as early as the second, third, and fourth month, but it is then pathologic. It may overstep the bounds of the normal by going through the uterine wall into the veins of the broad ligaments, and, especially if these are varicose, may lead to the development of phlegmasia of the limbs, both before and after delivery.

**Placentitis.**—Older writers described an affection of the placenta which we now classify under infarcts, but there does seem to be an inflammation of the chorionic villi which is secondary to endometritis (*q. v.*).

**Edema.**—An edematous placenta may resemble a syphilitic one, and the microscope may have to decide. The villi are club-shaped and swollen, with irregular contour. Usually the syphilitic placenta feels fatty, while one can squeeze water

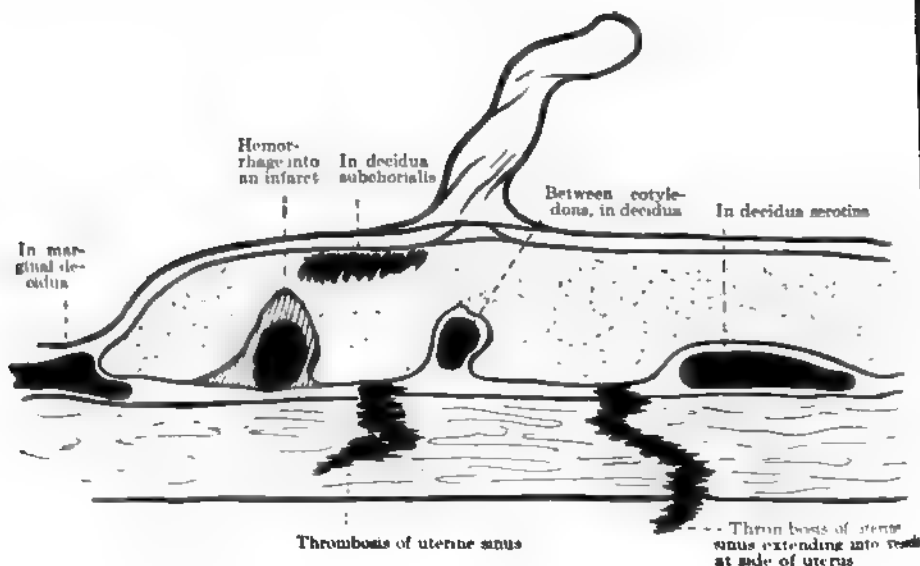


FIG. 401. — DIAGRAM SHOWING LOCATION OF HEMORRHAGES INTO PLACENTA AND THROMBOSES.

from the edematous placenta, which is pale, thick, soft, shaggy, and mushy, with torn serotina. The causes are maternal and fetal heart disease, nephritis, diabetes, and general anasarca from any source, polyhydramnion, and fetal blood diseases. Abortion is the rule. If the child is also edematous, formidable dystocia may result.

**Atelectasis.** Sometimes a placental cotyledon is completely infiltrated with fibrous material, solid, dark red in color, and hard to the touch. It occurs occasionally in placenta previa, the piece overlapping the internal os being in this condition, and it may make the diagnosis difficult.

The fibrous change may be concrete, or may be somewhat diffuse, giving the whole placenta a fibrous character. It may, therefore, interfere with the nourishment of the fetus, and probably has a pathology analogous to that of white infarct.

**Calcification.** Not infrequently the serotinal surface of the placenta is strewn with white, sandy deposits. These may be discrete or, rarely, may be fused together into little plates of hard, brittle masses. They are composed of calcium carbonate and phosphate and magnesium phosphate, lie in the upper layers of the

decidua serotina, especially around the "anchoring villi," are due to the deposition of the salts in areas which had undergone fibrinous degeneration, and are, therefore, associated with white infarcts; they have no clinical significance, are not syphilitic, though they may be found in luetic placentas,—usually in the vessels' wall,—do not always indicate that the gestation has been prolonged (since they are found in abortions), are not tubercular, and do not occur with especial frequency in any particular condition. It has seemed to me that they render the placenta stiff, which facilitates its separation and expulsion, and that usually no piece of a calcareous placenta is retained.

**Cysts of the Placenta.**—On the fetal surface, underneath the amnion and just under the chorionic membrane, cysts are not seldom found. They vary in size from the microscopic to that of a goose-egg, and are oftenest found on ripe placentas, it has been noted at all times after the twenty-second week, have clear yellowish cloudy and bloody content, contain albumin, mucin, fat, detritus, and various sodium and chlorine salts. Often a white infarct is found underneath the cyst, and, on opening the latter, the lining is seen to be of soft, whitish, shaggy, necrotic material resembling decidua. This is generally admitted to be degenerated Langhans' villi, which are large, hydropic, with a big nucleus and all fatty degenerated. It is believed that a few of these cysts may be due to degenerated decidua or the endometrium of large white infarctions or hemorrhages. Clinically, they are of no importance. If a large marginal cyst ruptured, one might think the bag of waters had opened (Seitz).

Various tumors are found in the placenta—myxoma fibrosum, angiomas, hyperplasia of the chorionic villi, but especially chorio-angiomas. All are exceedingly rare. Clinically, they are of little importance; only rarely do they affect a child or the delivery.

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ertion—*insertio velamentosa* (Fig. 493). Embryologists are still at variance to mechanism of the production of the aberrant insertion of the cord. Von Anquè's idea that the exceptionally good nutritional conditions of the reflexa d to the insertion of the abdominal pedicle here seems quite plausible, but is proved (Peiser).

Velamentous insertion is often found with other anomalies of the placenta, as arcs, placenta succenturiata, bilobata, and prævia. It is common with twins and the rule with triplets. To the child this abnormal insertion of the cord is dangerous only when the vessels run across the lower uterine segment; then its may be lost through hemorrhage, from tearing of one or more of the vessels when membranes rupture, or asphyxia from compression of the vessels and the cord ring the passage of the head. Both twins may bleed to death from the tearing of a vessel. Occasionally a diagnosis may be made before rupture of the mem-

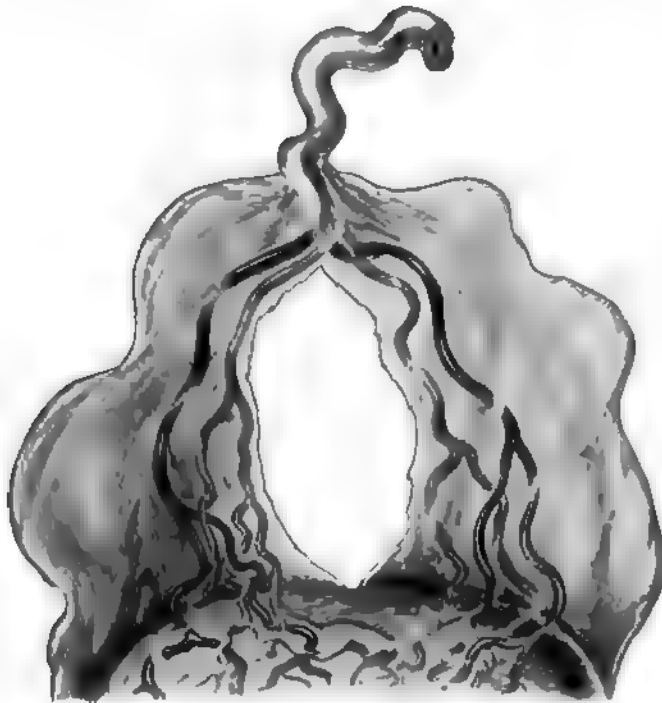


FIG. 493.—AUTHOR'S CASE OF VELAMENTOUS INSERTION OF CORD.  
Child passed through rent and was asphyxiated, but not anemic.

branes—the pulsating vessels may be felt inside the cervix coursing over the pouting bag of waters. These vessels are not in the forelying cord, because light pressure upward would displace the latter. A slight but continuous hemorrhage after the rupture of the membranes, with weakening and rapidity of the fetal heart-tones, is diagnostic. Placenta prævia and other maternal causes of bleeding are easily eliminated and by exclusion the true condition recognized.

*Treatment.*—If the diagnosis is made before rupture of the membranes, the latter must be delayed until dilatation of the cervix is complete, which is accomplished by placing a soft elastic colpeurynter in the vagina and putting the woman in the elevated Sims position. When the os is fully opened, the membranes are to be punctured between the vessels and delivery effected as rapidly as is consistent with the safety of the mother.

*Hernias* into the cord are not so very rare. This must always be thought of

n primiparæ, with attacks of suffocation when the attempt to lie down is nausea and vomiting, and symptoms referable to the kidney of pregnancy or nephritis. Emaciation may be marked, fever present; edema of the legs, and even the abdomen, with enormous distention of the latter, will be found. Uterus may be larger than at term, the belly so tight and tender that palpation is rendered negative, but fluctuation is usually obtainable. Striæ gravidarum on the skin, and often minute hemorrhages bestrew it; fetal parts are not palpable, and the heart-tones may be inaudible. Vaginally, the cervix is found high up, and the os usually opened. As a rule, acute hydramnion terminates in abortion before the sixth month, or the symptoms become so threatening that the attempt must interfere. Twins are often found in such cases, and a spontaneous abortion may follow if one of them should die.

**Diagnosis.**—If a diagnosis of pregnancy had already been made, the rapid enlargement of the uterus with abdominal symptoms will be easily explained. Hydramnion mole causes not such rapid growth of the uterine tumor, and, further, it is always complicated by hemorrhages. Generally, the first duty is to diagnose pregnancy, which is usually not difficult if all the aids are called upon. Contraction occurring in the abdominal tumor on one occasion enabled me to diagnose hydramnion when all other findings were equivocal. Ovarian cyst oftenest requires differentiation, but in this condition the uterus is usually found below the large distending tumor, the cervix is closed and hard (open and soft, with palpable membrane in hydramnion), and the symptoms and other signs of pregnancy are absent. It also shows the characteristic area of tympany around the navel, which changes position. Encysted (tubercular) ascites was once mistaken for polyhydramnion. In critical cases, where a diagnosis must be made, it is justifiable to use the puncture sound because, if the case really is acute hydramnion, the puncture of the membranes is the proper treatment.

Treatment of acute hydramnion is abortion, by letting off the waters, which is done slowly to avoid shock, the case being then left to nature, and other treatment being made only on special indication.

**Chronic Hydramnion.**—This differs from the acute in that the course is much longer—it does not lead so often to abortion, though premature labor is frequent. It is commoner and a little more amenable to treatment. It may occur in late gestation, which renders diagnosis very difficult. Causation and symptoms are the same as in the acute form, but the latter are less marked and of longer duration. Enormous distention of the uterus may occur, with resulting cardiac distress from venous insufficiency. The patient may be annoyed by false labor pains for some time before delivery. The diagnosis lies most often between hydramnion and multiple pregnancy; it must be remembered that they are often associated. In one of my cases the bag of waters, felt over the internal os, was relaxed, while the uterus, felt externally, was very tense, a fact which Rémy and Ahlfeld noted, and which I relied upon for the diagnosis of hydramnion of the upper twin. Fluctuation is obtainable only in the hydramnionic sac; it does not pass through the septum between the twins.

**Prognosis** of acute hydramnion is good for the mother, because abortion terminates the case early. In general the prognosis is not bad, but one must remember the dangers—kidney lesions, cardiac collapse, respiratory failure, pneumonia, and hydropleura. Labor may bring added troubles—for example, in the prodromic first stage, sometimes lasting days, prolapse of the cord when the membranes rupture and the sudden rush of the waters takes place; abnormal positions and positions of the child, weak labor pains, the last three requiring interference; atonia uteri and postpartum hemorrhage, which often is fatal.

The sudden rush of the waters, besides causing the mentioned anomalies, may leave so small a uterine cavity that abruptio placentæ results, or the heart

## SECTION VI

### THE PATHOLOGY OF LABOR

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AN obstetric case is a surgical case, with more than the usual surgical aspects. Older writers used to speak of eutocia and dystocia, the former meaning normal, the latter abnormal, labor. No two authorities are agreed as to where eutocia ends and dystocia begins. Most authors believe that labor in the human female borders very closely on the pathologic, but I am convinced that, today, measured by our present standards, labor cannot be called a normal function. To mention only one reason for so considering it, the almost invariable injury to the pelvic floor may be cited. No other function of the body, normally executed, is attended by permanent damage to structure. Should such damage occur, we call the process pathologic and pathologic. I believe that the notion that labor is normal is a fallacy, and that this fallacy is fundamentally responsible for the still high mortality and morbidity which attend the parturient function. Taking for granted that parturition is normal, the State allows ignorant midwives and half-instructed medical students to assume the heavy responsibilities of its conduct. Since the public is taught to believe that labor is physiologic, it refuses to recognize the dignity of the science and the high degree of art, of obstetrics, and, as a result, the field of its practice is not made inviting to the best men of the profession. Such a state of affairs naturally explains why 20,000 women die every year in our country from the effects of childbirth, why nearly every mother carries the marks of injury inflicted during labor, and why a hundred thousand infants are annually lost during delivery.

It is best to regard every labor case as a severe operation. Like the surgeon, the obstetrician should consider the strength of the patient in standing the shock, the asepsis and antisepsis, the nature and technic of the operation, and, finally, all the complications which are likely to arise.

So, during labor, it is necessary and our duty to have a clear knowledge of the patient's condition, especially of the heart, lungs, kidneys, and blood; second, we must know accurately what is going on during the labor, that is, we must be thoroughly acquainted with the mechanism of the particular labor, the strength of the powers, the greatness of the resistances, and the relation between them; third, we must be aware of all possible complications and the particular ones likely to arise in this particular case, and know how to prevent and treat them; and, finally, we must know and practise the strict principles of asepsis and antisepsis, that the best standards demand. To meet all these obligations is the duty of the obstetrician, and a conscientious man will find little time for idling at a labor case. It requires studious regard of the patient during her pregnancy, and getting her into the best possible condition for the ordeal of parturition. It requires a prompt response to the call to the labor, a careful and painstaking examination on arrival, and a proper valuation of all the conditions found. It requires attentive conduct of the case from the beginning to the end, and a preparedness for doing the usual work of delivery, plus far-reaching provision and ability for all emergencies.

In general, the abnormalities of a labor may be classed under three heads: 1) Anomalies of the powers; (2) disproportion between the passage and the passagers; (3) complications on the part either of the mother or of the fetus.

## CHAPTER XLVIII

### ANOMALIES OF THE POWERS

**IN** the first stage of labor the uterus does all the work. Regularly, with increasing frequency and strength, its muscle contracts, slowly reaching an acme, then relaxing. In this way the lower uterine segment is developed, the hydro-tic bag of waters formed, the cervix effaced, and the os dilated. In the second stage the larger part of the work is done by the abdominal muscles. The uterus by this time is well drawn up over the child and can exert but little power. While in some instances the uterus expels the child unaided, its main action in this stage is pressing the presenting part against the pelvic floor, which, reflexly, elicits the action of the abdominal muscles—the bearing-down efforts. In discussing this subject, therefore, we will consider, first, anomalies of the uterine and second those of the abdominal action.

**Anomalies of the Uterine Action.**—The pains may be too weak or too strong, or seldom or too frequent, too short or too long, and they may be irregular in time and in character, too painful, or, rarely, painless. Even normally, much variation may be noted as regards the time, rhythm, and strength of the labor pains in different women. Knowledge of the character of the pains in preceding labors will enable us to predict the kind of uterine action in subsequent deliveries, since they are usually much alike, but exceptions are not rare.

**False pains** are the contractions of pregnancy, which, toward the end of gestation, become perceptible, even painful, to the gravida. They are especially marked at the time of lightening, and may force the head down into the pelvis. According to Schatz, they recur with a certain periodicity, the intervals being less by one-half as term approaches. All the usual symptoms of an actual labor pain may be present, that is, pain, hardening of the uterus, regularity, even dilatation of the cervix and rupture of the membranes. Most authors regard the last two as indicative of the beginning of actual labor. Indeed, it is often impossible to say when pregnancy ends and labor starts, but these points may help in the diagnosis: false, or pregnancy, pains are of even intensity, while true pains grow stronger apace; they cease after a day or so; they are out of the time of the expected labor, and if their time, *i. e.*, whether they appear at intervals of three, four, or six weeks, is known, they will recur on the days which would correspond to the end of one-half of the previous interval; while the cervix may open, it is not shortened nor effaced, the membranes rarely rupture, and the bloody show does not appear. False pains are not strengthened by pituitrin (Hofbauer). It is important to recognize the false pains and treat them as such, because if the woman were considered to be in labor, when actually she is not, much unnecessary and harmful examination and interference might be instituted. Treatment consists of rest in bed, narcotics, and expectancy. The author does not agree with those who would allow such a case to continue far beyond the normal term of pregnancy. (See Prolonged Pregnancy and Induction of Labor at Term.)

**Weak Pains.**—*Inertia uteri*, atonia uteri, or uterine atony may show itself in, first, infrequent contractions, feeble contractions, and too short contractions; usually the three are combined. Clinically, we must describe the condition as it affects the first stage, or the dilatation of the cervix; the second stage, the expulsion of the fetus; and the third stage, or the period of the after-birth. In the first stage

**Prognosis.**—This depends on the cause. The greatest dangers are sepsis from long waiting, from too many internal examinations and manipulations, and the uries inflicted by too early and unnecessary operating.

**Treatment** should be varied with the cause, and is medical or mechanical. One the best remedies is to put the patient to sleep, and morphin,  $\frac{1}{2}$  grain hypodermically, with 40 grains sodium bromid per rectum, may be used. Morphin is safe for the child only early in the first stage of labor. The effect is better if the parturient is given a full warm bath beforehand. While in the tub, the genitals are protected against the access of the infected bath-water by means of a large pad of cotton. After a good sleep the patient usually has regular, vigorous pains. Ergot is never used, and morphin seldom. Though some practitioners report success with the latter drug, my own experience has been negative, and several times it seemed to cause the premature discharge of meconium and annoying postpartum oozing. Sugar in half-ounce doses has occasionally seemed to help. If a stimulant is desired, strychnin,  $\frac{1}{10}$  grain every three hours, and hot coffee may be used. Much patience is to be exercised, and suggestion, with mental and moral support, must be given the parturient. In many instances a large dose of castor oil will prove effectual. Latterly, pituitrin, 3 to 5 minims hypodermically every three hours for one to four doses, has been used with success in pure atonia uteri.

**Pituitary extract**, pitu-glandol, hypophysin, pituitrin, glanduitrin, are all names for the solution of the active principle of the posterior lobe of the hypophysis cerebri. The action of this glandular secretion upon the uterus was discovered by Dale in 1907, and published by Fränkl-Hochwart and Fröhlich in 1909. W. B. Bell, in 1909, first used it in labor, but it became better known as oxytocic when Hofbauer recommended it. The drug seems to affect all unstriated muscular tissue, the blood-vessels, intestine, and bladder, as well as the uterus, but it contracts the latter most markedly. From two to eight minutes after the hypodermic injection of 1 c.c. of hypophysin the uterus contracts strongly. The pains are both strengthened and made more frequent, the effects lasting from thirty to ninety minutes, depending on the quality of the preparation used and the patient. Sometimes there is none or feeble action, sometimes an unusual effect, such as tetanus uteri. Kahn says it has another action, increasing the coagulability of the blood.

Since hypophysin strengthens the pains, it shortens labor, and were it not for its not infrequently untoward effects one would advise a very general application of the remedy. Pituitrin will not induce abortion, and only rarely, and in large doses, will it bring on labor at term. It does not stimulate the lacteal secretion, and has only slight action on the bladder. Sometimes it seems to aid peristalsis and the removal of flatus.

**Indications.**—(1) Weak pains in the second stage of labor and occasionally near the end of the first stage if the cervix is dilatable. Properly used, and sometimes aided by episiotomy, forceps may often be avoided. (2) Weak pains in the second stage when the patient is in twilight sleep. (3) Postpartum hemorrhage from atony. It sensitizes the uterus, aiding powerfully the action of ergot, which is to be given at the same time. In cases of obstinate uterine atony it is injected directly into the uterine muscle through the abdominal wall. (4) At cesarean sections, directly into the muscle—avoiding the veins—if the uterus does not contract promptly. (5) After laparotomies (not cesarean section) to reduce tympany (carefully). (6) or late puerperal hemorrhages.

**Conditions and Contra-indications.**—The following accidents have been reported: (1) Tetanus and strictura uteri with incarceration of fetus and death; (2) too prolonged uterine contractions with fatal fetal asphyxia; (3) rupture uteri (many cases); (4) pressure necrosis of soft parts; (5) atony of uterus postpartum and hemorrhage; (6) deep cervical and perineal lacerations (frequent); (7) eclampsia (?); (8) toxic convulsions in the infant (?); (9) collapse, especially when injected intravenously, and even stenocardiac attacks; (10) cerebral disease in the child; (11) crisis of uterine wall (given at cesarean section) and fatal peritonitis (Süssman).

Pituitrin should not be given where there is any danger of rupture of the uterus, *i. e.*, in contracted pelvis, malpresentations and malpositions, tumors blocking the passage, fibroids, diseased uteri, *e. g.*, scars from previous section. It may not be used early in labor or when the cervix is closed or undilatable. If the head is not engaged it may be exhibited only after the accoucheur is convinced that feebleness of the pains is the sole cause of the head remaining high. Heart disease and the dangers of a sudden increase of blood-pressure, cerebral hemorrhage in lachrymia, atheroma, contra-indicate, also threatened asphyxia of the child *in utero*.

Pituitrin may be used only in the presence of a clear-cut scientific indication after the conditions have been fully met. (See Mundell. The dose is 3 to 5 minims.)

**Mechanical measures** are: hot sitz-bath; hot-water bag to the fundus; uterine massage; letting the patient change her position or walk about; electricity to the uterus (useless in my experience); the electric vibrator applied evenly over the fundus; a hot milk and molasses enema (very effective); hot vaginal douches (115°

uragement and instruction of the parturient and the above measures are to be applied, and easily 75 per cent. of the forceps operations in done for indications of this nature.



FIG. 496.—KRISTELLER EXPRESSION.

ove remarks apply to the treatment of weakness of the abdominal en the second stage is well on, and the head deeply engaged in the visible in the vulva. If the head is not engaged, but still above the se is much more formidable. What was said regarding the treatment



VIED RITZEN'S MANOEUVRE, PRESSING THE HEAD OUT WITH TWO FINGERS AT EITHER SIDE OF RECTUM.  
Drawn from a photograph.

rs in general applies here. Unless the head can be gotten to enter the usual means, a high forceps operation or version and extraction will both of which are dangerous, under such circumstances, because of the d extent of the necessarily inflicted lacerations, and the usually severe



accumulate in the uterus, paralyzing it, after which the organ balloons out—that is, tympania uteri develops. In such cases the bacterium coli is usually found. Unless relief is brought, the woman dies of sepsis or exhaustion, or both.

**Stricture Uteri.**—A spasm of a zone of circular fibers of the uterus may imprison the fetus. Sometimes the constriction is around the child's neck, as in Fig. 498, and sometimes around the trunk or breech, a groove around the arms and chest having been demonstrable in a case delivered at the Chicago Lying-in Hospital. Ordinarily, the contraction of the remainder of the uterus is not strong enough to rupture the lower uterine segment, which is in spasm, nor, indeed, to overcome the resistance of the constricting ring. Therefore labor comes to a standstill, and we

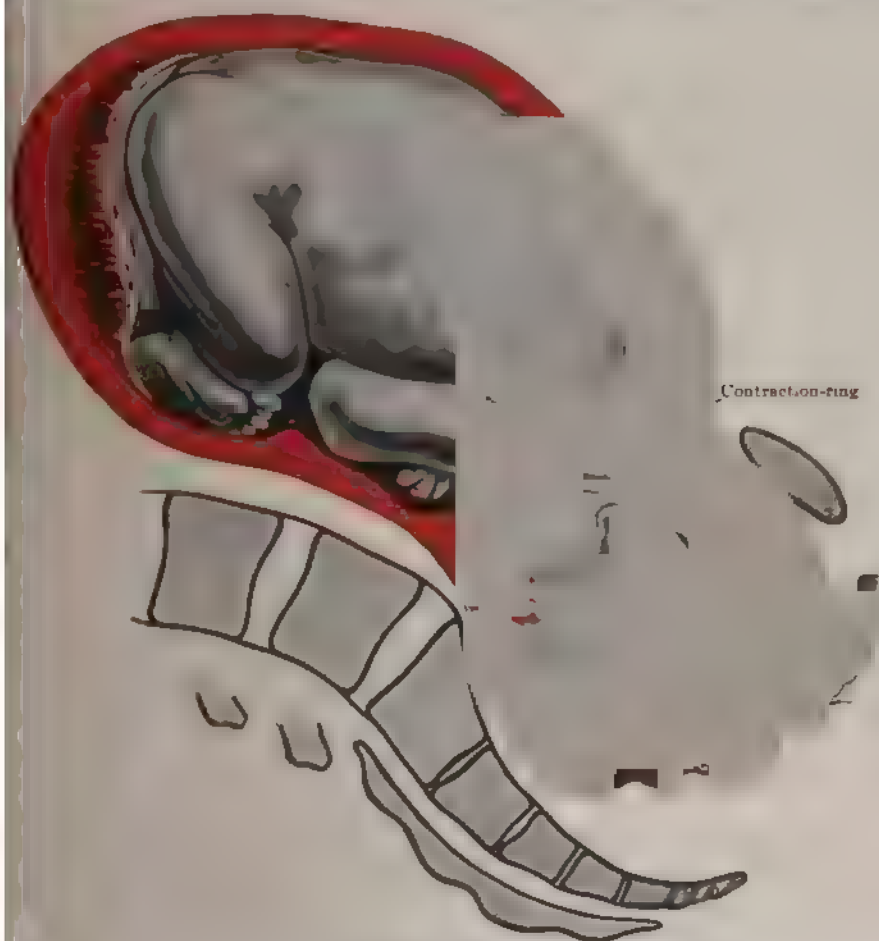


FIG. 498.—CONTRACTION-RING AROUND CHILD'S NECK.

and the same clinical picture as in tetanus uteri (*q. v.*), though not so aggravated nor so quickly fatal. The contractions are irregular both in frequency and in strength, are very painful, and the woman is frenzied by the delay in labor in spite of constant and prolonged suffering. The lower part of the uterus is hard, the fundus soft (between pains), and the lower abdomen is very tender. Attempts at version may be rendered futile by the stricture if they do not rupture the uterus. In one of my cases the whole fetus was locked in above the stricture, which was so narrow that I could not insert more than three fingers (Fig. 499).

Strictures are oftenest found in primiparæ of neurasthenic type and in women in whom the bag of waters ruptures early in labor. After a while progress ceases,

uited. A prolonged hot bath, followed by a hot drink of lemonade containing 3rams of alcohol, will often be productive of gentle perspiration, sleep, and calm. Early in the first stage a small dose of morphin may be given. Sodium bromid up to 60 grains may be exhibited, but chloral at all times and morphin, except as above stated, are dangerous, the first because of its cytolytic influence on the liver, the latter because of its narcotic effect on the baby. Green, of Boston, recommends copolamin-morphin for the nervous, apprehensive parturient. Change of position from back to side, the elevated Sims, or the knee-chest, and walking about may be tried. Vaginal examinations are restricted, and all attempts to dilate the cervix omitted.

If the uterus is tetanically contracted, it will seldom respond to the above treatment and delivery is indicated. A prime requisite for any and all intra-uterine manipulations in tetanus uteri is profound anesthesia. Ether is to be preferred because the patient must be brought close to the danger-line of narcosis, and the operation must not be begun—not even the hand introduced until the uterus has relaxed. In very rare instances a prolonged, deep chloroform narcosis failed to quiet the uterus; delivery from below proved impossible, and cesarean section had to be performed.

**Spasm of the Cervix; Strictura Cervicis.**—Many authors deny the existence of spasmodic rigidity of the cervix. Fieux proved that there are practically no muscular fibers in the cervix around the external os near term. Nevertheless, a few cases in the author's experience have shown that occasionally the cervix will contract, either in front of the presenting part or, more commonly, around the neck after the head is through it, or after the body is delivered in breech presentation, and thus create an obstacle to delivery. Most of the cases of so-called rigidity of the cervix are not spasmodic, but anatomic, due to some alteration of structure. The causes, diagnosis, and treatment are on the same lines as those of strictura uteri. Stricture of the cervix around the after-coming head is often more apparent than real, though the effect is serious, just the same. The slender body slips through the unprepared cervix, but the head is arrested. Such a cervix, not dilating with gentle efforts, may have to be incised.

**Precipitate Labors—Too Strong Pains.**—Too strong uterine action and too strong abdominal action are sometimes observed, and they lead to the too rapid delivery of the child. Since the abdominal action is mostly reflexly excited by the uterine pains, when the latter are strong, the former will also be strong. Then, too, even after long labor, the first stage having been very slow, characterized by either atonia or myoclonia uteri, when the head finally has reached the perineum, its presence here may evoke such powerful abdominal action that labor is finished entirely too quickly.

Precipitate labor is the forcible, violent expulsion of the child in a period of time disproportionate to that normally required for the safe overcoming of the resistances. Sometimes the woman has pains for several hours, but does not recognize them as true labor pains, and sends for the accoucheur too late. These labors should not be called precipitate. Many cases are on record where the uterus, without warning, suddenly became violently active and expressed the child in a few minutes to an hour. The woman may be thus overtaken on the street and not have time to run to shelter. In her excitement she may forget to lie down, and the child may fall to the ground, the cord breaking. In a case in the dispensary service of the Chicago Lying-in Hospital the mother was lying down and the child was hurled against the foot of the bed, the cord breaking, but the child was not injured. In another from the same service the child fell to the floor and died from a fractured skull. Very important are these cases from a medicolegal point of view, since the other, if she was delivered alone, may be accused of having killed the child. The best authorities (Freyer) are now agreed that the excitement and pain incident to such an event can produce a state of mental aberration which may persist during the

## CHAPTER XLIX

### ANOMALIES OF THE PASSENGERS

**Classification.**—Under this caption are to be considered irregularities of the mechanism of labor due to the child. While those due to the placenta might belong here, it is best to take them up with the study of postpartum hemorrhage. Anomalies of the mechanism of labor are due to errors of attitude, of presentation, and of position of the child, and also to the overgrowth of the fetal body as a whole or as a part. Before taking up this branch of the subject the student is advised to read what was said about the mechanism of normal labor, for the following pages will deal mainly with descriptions of the factors of labor gone wrong. For quick and clear orientation regarding the relations of the fetus to the mother, and the various movements executed in the mechanism of labor, a pelvis and fetal head are almost absolutely necessary, though the little models and paper manikins on the market will aid very much. It is also necessary to have clear notions regarding the terms used in describing all phases of the subject.

"Attitude" or posture means the relation of the parts of the fetus to each other; "presentation" is the part of the fetus which lies over the os, or is bounded by the girdle of resistance, and "position" means the relation of any given arbitrary point in the presenting part to the four quadrants of the mother's pelvis. The name of this arbitrary point is the "point of direction." It might also be called the "denominator." To a certain extent attitude determines presentation; for example, when the head lies over the inlet, not in its usual condition of flexion, but with the chin extended, face presentation results. If the head is less deflexed, brow presentation, and if only partly deflexed, the vertex being felt over the os, median vertex presentation is diagnosed. These might be grouped together as "deflexion attitudes." In addition to these, the result of errors of attitude, there are abnormal presentations produced by errors of polarity of the fetus, such as breech and shoulder presentation. Other anomalies of attitude are prolapse of the feet in breech presentation, of the arm in head presentation, of the cord in all presentations, etc. Just as in occipital presentations, each of the abnormal presentations may lie in different positions. Following Baudelocque and Hodge, six positions were distinguished in occipital presentations—O.L.A., O.L.T., O.L.P., O.D.A., O.D.T., O.D.P.—and six may be described for most of the abnormal presentations, though not all are observed in practice; for example, Sac.L.A., S.L.T., S.L.P., S.D.A., S.D.T., and S.D.P. In breech presentation S.L.A. and S.D.P. are the ones almost exclusively observed.

Finally, errors in rotation of the presenting part occur; either rotation ceases before its completion, or the presenting part turns backward into the sacrum, causing severe dystocia. It is thus evident that an almost infinite variety of combinations of presentations and errors of attitude and position may be presented to the accoucheur for study, and when it is considered that, in addition, a contracted pelvis, a large child, twins, or monsters may coexist, not to mention all superadded complications incidental and accidental to parturition, one must concede that truly formidable problems of deep complexity are offered for solution.

**Unusual Mechanisms of Head Labors.**—In order will be discussed errors of rotation in occipital presentations and the deflexion attitudes—median vertex, forehead, brow, and face presentation.

**multiparous.** They are due to the fact that the head passes through, presenting larger planes than usual, and also to the fact that the perineum is much and forcibly dislocated downward—torn off, in fact, from its bony and vaginal attachments.

Abdominally, in thin women, the diagnosis may sometimes be made by a glance—over the pubis there is a distinct hollow. Palpation reveals the shoulder far back from the median line, and the forehead can usually be felt over the opposite ramus pubis. The heart-tones are deep in the flank and distant from the ear, although if, as sometimes occurs, there is a moderate deflexion of the head, the chest is pushed forward against the abdominal wall and the heart-tones are very loud and distinct. They are then on the same side as the forehead, opposite to that on which the back may be felt, and this finding may give rise to erroneous diagnoses of face presentation or of occiput presentation, the accoucheur believing the occiput is on the side other than the one truly present. Internally, early in labor the head is felt high up, usually partly deflexed, the small fontanel being higher, or on a level with the large, which is nearer the center of the pelvis. Unless the pelvis is contracted or the belly pendulous, the head is synclitic. If anterior rotation is going to occur, flexion takes place with descent. The palpating finger will discover the

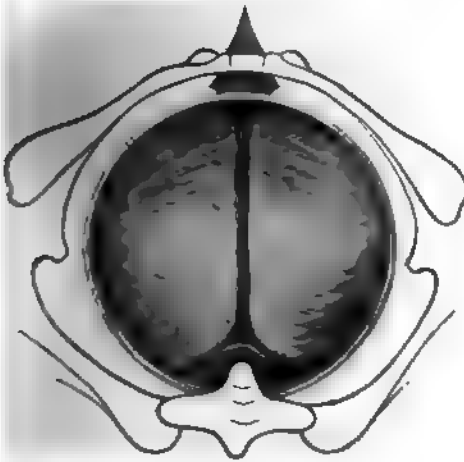


FIG. 504.—TOUCH PICTURE OF OCCIPITOSACRAL POSITION. FIRST MECHANISM.

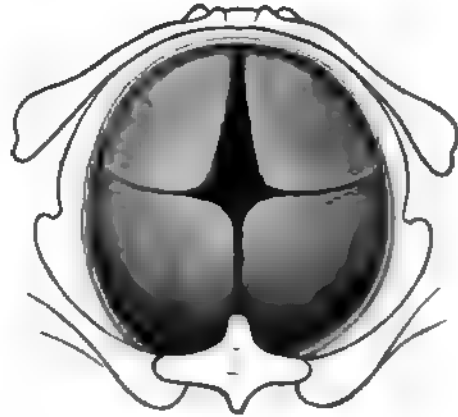


FIG. 505.—TOUCH PICTURE OF OCCIPITOSACRAL POSITION. SECOND MECHANISM.

tendency of the small fontanel to turn to the front during the pains, or will find it easy to push the occiput in this direction. If posterior rotation is to be the mechanism, the head descends in moderate extension, this attitude of the child having been called "military," that is, the head is set squarely on the shoulders. As the occiput turns into the hollow of the sacrum, the finger feels the small fontanel deeply on the rectum, and the large one behind the pubis, the sagittal suture running nearly anteroposteriorly and from above forward, downward, and backward. If the first mechanism of delivery, that of extreme flexion, is the one selected by nature, the large fontanel is felt just under the pubis; if the second, that of extension, the large fontanel lies in the center of the pelvis, and the glabella will be felt behind the pubis (Figs. 504 and 505). Owing to the usually large caput succedaneum, it is not always easy to outline the sutures, and under these difficulties the finger is to be passed to the side, until the ear is found, when the direction of the tragus will bring clarity. Not seldom the accoucheur is surprised by the head being delivered with the occiput over the perineum, when he was anticipating a normal mechanism.

**Prognosis.**—Mortality and morbidity are higher for both mother and child in occipitoposterior positions. For the mother, exhaustion and sepsis from prolonged labor, and the frequently necessary operations, with the almost inevitable lacerations,

tions, are to be feared. Postpartum hemorrhage from secondary inertia *uteri* is not rare. For the child, asphyxia and the operative delivery bring danger, and without doubt, in the author's opinion, more children are lost from this complication than are lost from the effects of contracted pelvis.

**Treatment.**—When the head is high, "floating" above the pelvis, "capitallabile," it is best not to interfere. A complete examination is to be made to determine the existence of a contracted pelvis or other anomaly which may require treatment for its own sake, and also, if possible, the cause of the occipitoposterior position. During the usually prolonged first stage the woman should walk around or lie on her back in bed, until the head engages. Rupture of the bag of waters retards, rather than hastens, labor in these positions, both by interfering with the mechanism of labor and by removing the hydrostatic cervical dilator, and besides loss of the liquor amnii makes version, if the case comes to it, much more difficult or even impossible. Watchful expectancy is the treatment until an indication for interference arises. If the labor drags on, and danger to either mother or child while not imminent, is to be anticipated, dilatation of the cervix may be hastened by the use of the colpeurynter. If the head remains high long after complete dilatation, it may be advisable to anesthetize the woman, change the position to one anterior, impress the head into the pelvis by combined manipulation or draw it down with forceps, and then leave the case to nature. In primiparae this method is far more preferable than version, which almost always kills the babies and always lacerates the mother.

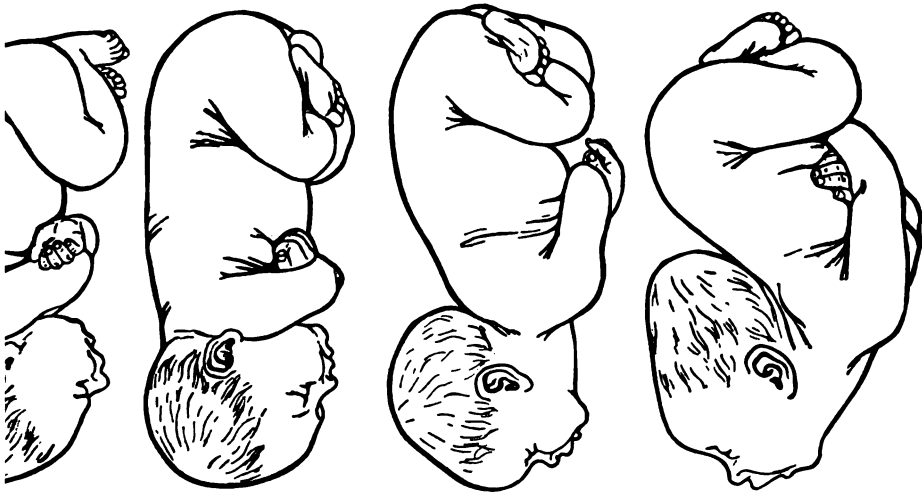
After the head has engaged, watchful expectancy is still practised, because the vast majority of cases terminate in anterior rotation, or at least in rotation to beyond the transverse diameter, and thus become easy forceps operations. Change in posture, even the knee-chest, may be tried, but most of the time the woman should lie on the side to which the occiput points. By this means the breech thrown over to the side, the spinal column is straightened, the occiput is forced down, flexion increased, and, therefore, rotation favored. Sometimes a change to the side position will strengthen uterine action. Hodge's maneuver may be helpful—upward pressure on the sinciput during pains. This, by increasing flexion, favors rotation. Tarnier advised direct rotation of the head with the fingers half-hand, operating from behind the ear, at the same time pressing the forehead the rear from the outside. Older writers, among whom Hodge may be mentioned, recommended the vectis for these cases. Objections to all these maneuvers may be urged on the score of danger of infection and inefficiency. In multiparae they occasionally succeed, and may shorten the labor somewhat. At all events, they should not be persisted in, and much force may not be used, but if an indication arises for interference, it is best to make the manual correction of the malposition under anesthesia, as is described in Chapter LXX, page 956. Failing the latter recourse is to be had to forceps. If failure of rotation is due solely to weak perineal hypophysis should be given.

Occipitosacral positions often require assistance. If the head is descending in flexion, the perineum is not endangered as much as when the forehead comes down. In either case a deep episiotomy is indicated unless the patient is a multipara. (Chapter on Forceps.)

**Internal Super-rotation.**—In roomy pelvises, or when the child is small, anterior rotation of the occiput may be exaggerated, the small fontanel passing beyond the middle line to the opposite side of the pelvis. An O.L.A. may, in the course of labor, become an O.D.A. The accoucheur will be surprised to find the back on one side and the occiput on the other, but sometimes the back rotates too and the attendant will imagine his first diagnosis was wrong. Indeed, occasionally the head will rotate through the hollow of the sacrum from an O.L.P. to an O.D.P., and the back, which at first was on the left, later lies on the right, side. In internal super-rotation the head in the course of delivery may turn back again, or may escape in an oblique

ter of the outlet, the back pointing to the side opposite that of the occiput, but times the trunk follows the rotation of the head, and may escape with the back going directly upward, or even to the side to which the occiput had rotated. A lateral movement is thus imparted to the child.

Again, though the head comes out in the normal mechanism, the shoulders hyper-rotate, the back coming out on the side opposite that to which the occiput was pointed. A knowledge of these variations of the mechanism of delivery is necessary for the proper conduct of the end of the second stage. As a general rule, nature needs no help. When the delivery of the trunk is too slow, the woman should be asked to bear down; a moderate pressure may be exerted on the fundus, action on the child is made only when absolutely necessary. In doing this the coucheur should aid and supplement the mechanism evidently intended by nature. For example, if, after delivery of the head, external restitution does not occur but the shoulders show a tendency to turn in a direction opposite to that which was expected, the attendant should favor the movement, because if he sought to correct a contrary one, the child would stop in its rotation and the back would



DEFLEXION ATTITUDE. MEDIAN VERTEX PRESENTATION.

FIG. 507.—DEFLEXION ATTITUDE. FOREHEAD PRESENTATION.

FIG. 508.—DEFLEXION ATTITUDE. BROW PRESENTATION.

FIG. 509.—DEFLEXION ATTITUDE. FACE PRESENTATION. DEFLEXION COMPLETED.

out transversely, with injury to the perineum or fracture of the child's clavicle, needed, the delivery of the body would be arrested, requiring strong traction in order to free it.

**Deflexion Attitudes.**—Often, during an examination early in labor, the head is lying over the inlet with the large fontanel lower than the small, or even with the tip of the nose and the eyes palpable. After regular uterine action is established or if the parturient adopts a favorable posture, the small fontanel will sink or will assume a normal mechanism. Should the cause of the abnormal attitude of the child persist, the body of the child will remain in the wrong posture, the trunk will fix the trunk and adapt itself permanently to the abnormal conditions, a pathologic mechanism resulting. All degrees of deflexion of the head may be met, but it would be useless and confusing to describe them all. Clinically, four deflexion attitudes deserve mention as distinct presentations, having a well-defined course and mechanism. Named in the order of the degree of deflexion, they are: (1) Median vertex presentation, or "military" attitude; (2) forehead presentation; (3) brow presentation; (4) face presentation. In all these the trunk of the child passes, in a varying degree, from its natural condition of flexion

or C shape to one of extension or S shape, face presentation represents greatest change (Figs 506-509).

*Causation.* All cases of deflexion attitudes cannot be explained by one and often several factors combine to produce the abnormal presentation. general, primary and secondary factors may be distinguished, i. e., those during pregnancy and those showing in labor. The primary factors are any that will cause a straightening of the child's trunk, as tumors of the fetus, tumor of the uterus pressing in the fetal back, a congenitally long uterus which cannot itself well to a curved fetal back, obliquity of the uterus, tumors of the neck

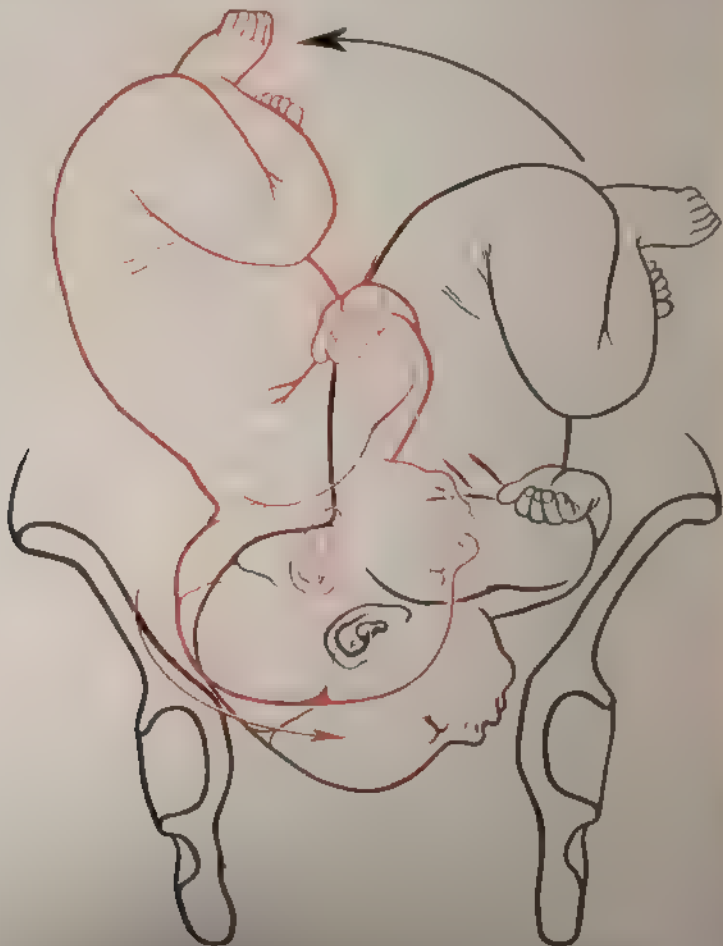


FIG. 510. —SHOWING CORRECTION OF FACE PRESENTATION BY POSTURE.

fetus, as goiter, a short, deep-chested child which does not all come on when the infant happens to have his head extended. segment may lock the child in this position. Baudelocque of wrong direction of the uterine forces when the uterus was ob before engagement, the back falls too far over to the side extends, and if, now, uterine action commences, the fetal in the due to increase the extension, even by the engagement of the fetus, turning a

the child should the long the attitude the occiput the axis pre to the face — of the high degree

tus, is a predisposing factor. Secondary causes are: (1) Those conditions prevent or delay engagement of the head, as contracted pelvis, large head (babies are often large), pendulous belly, tumors occupying the lower uterine cavity, as the placenta, or narrowing the inlet—the full rectum, full bladder; (2) Rupture of the bag of waters when the head happens to be in extension; (3) Occipitoposterior positions; (4) a cause of deflexion attitudes not generally appreciated is weak labor pains. With a normal pelvis the cervix exerts a certain influence on the mechanism of labor. The head presenting to it with the broad vertex will, under strong vis à tergo, adapt itself so as to bring the longest diameter of its ovoid into a position parallel with the axis of the passage, so that it can go through with the least friction. With weak pains the head will not adapt itself to the cervix and thus come under the latter's influence.

Very early always the cause of deflexion is maternal, and operates during labor, but the author would emphasize the rôle that the child plays. Nutatory movements are often felt during vaginal examination, and it is easy to understand that, after labor come on or the membranes rupture while the child has the chin ex-



FIG. 511.—MEDIAN VERTEX PRESENTATION. MILITARY ATTITUDE.

the attitude will be fixed, and the deflexion may become exaggerated as labor progresses. For example, in occipitoposterior presentation a slight extension may allow the forehead over the inlet. Should the patient turn on the side to which the venter of the fetus points, the trunk will fall over to that side and the head sink lower, and if pains come on strongly, the bregma will stem on the pelvic inlet and a full-face presentation result. Often early in labor the examining finger feels the brow or the forehead high over the inlet, but by properly turning the patient—that side to which the occiput points—the breech will fall back, the occiput will sink, and flexion result. If the obliquity of the uterus is not corrected, a face presentation may be made. These passing attitudes should not mislead to hasty interference.

**Mechanism of Labor in Median Vertex Presentation.**—Most authors do not mention the form of anomaly, but Baudelocque, Velpeau, and Hodge have mentioned it first, among other modern writers, mentions it. I believe it is a dystocia. When the deflexion is only moderate, the child presents in the "military" attitude, labor is very similar to that in vertex presentations. As the point of direction, or denominator, the occiput is high enough sometimes in abnormal mechanisms the forehead de-



ascends and becomes the point of direction—a fact of great importance in the forceps operation.

Engagement of the head is slow, because the largest plane, the occipitofrontal, is presented to the inlet. Descent continues with the large and small fontanels on the same level,—that is, flexion remains absent,—and with the sagittal suture in the transverse, until the median vertex reaches the pelvic floor (Fig. 511). Now four terminations are possible: (1) Flexion occurs, the occiput rotates anteriorly under the pubis, and labor terminates normally; (2) delivery takes place with the sagittal suture in the transverse diameter—requires strong pains, large pelvis, small child, the perineum being much endangered; (3) the occiput rotates into the hollow of the sacrum, the forehead turns to the pubis, and the mechanism is similar to occiput posterior positions, second mechanism, deflexion; (4) labor comes to a standstill with the head in the transverse diameter, deep in the pelvis, and, unless art is called

the mother and child may die. These last cases can hardly be distinguished from arrested rotation in occiput posterior positions. They are both “deep transverse arrest,” and require the same treatment. Molding in median vertex presentation closely resembles that of forehead presenta-



FIG. 512.—MOLDING IN MEDIAN VERTEX PRESENTATION.

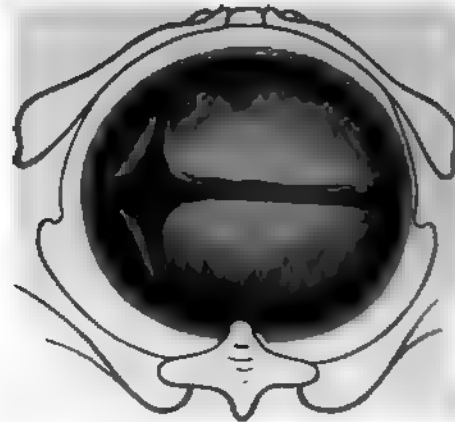


FIG. 513.—TOUCH PICTURE. MEDIAN VERTEX PRESENTATION. O.L.T.

tion. The caput succedaneum is on one parietal bone, close to the posterior third of the sagittal suture (Fig. 512).

*Clinical Course.*—Labor is longer and tedious. The pains are weak and infrequent, because the presenting part does not press firmly against the cervix. Dilatation is slow, and the cervix must be opened wider to allow the head, presenting its biggest planes, to pass through. After the head reaches the pelvic floor the pains usually become augmented, and one of the terminations mentioned occurs, but in all cases strong pains are needed. These may fail, and the assistance of art is often required.

*Diagnosis.*—Abdominally, the usual points for determining presentation and position are to be sought, and the examiner will notice that the trunk of the child is very straight, the fundus applied to the ensiform, the heart-tones near the median line, and heard over a large area—distant in O.L.T., louder in O.D.T. The shoulder is in the median line, just above the pubis. Internally (Fig. 513), the finger discovers the two fontanels on the same level, the sagittal suture running across the pelvis. Usually the head is synclitic, but anterior asynclitism has been observed,

pecially in pendulous abdomen and flat pelvis. Naturally, the findings change as the various mechanisms unfold. Rectally the experienced finger can feel the fetal suture crossing the pelvis.

**Treatment.**—This is the same as that of occipitoposterior positions.

**Forehead Presentations.**—These are primary or secondary. Primary forehead mechanisms are very rare because, if the deflexion has proceeded thus far, the descent of labor almost always complete the process, a face or at least a brow presentation resulting. The forehead is the point of direction—it takes the lead, descends first, usually in one of the obliques, until the presenting part reaches the pelvic inlet. Now three mechanisms occur: (1) Under strong pains and late, flexion of the head, descent of the occiput, and anterior rotation of the latter under the pubis (rare); (2) anterior rotation of the forehead under the pubis while the occiput remains behind, the glabella stemming under the arch, the occiput coming over the ischium, in all respects similar to the second mechanism of occipitoposterior positions; (3) cessation of progress with the forehead on the perineum.

Secondary forehead presentations are the result of deflexion of the head and descent of the forehead in occipitoposterior positions, to which the reader is referred for a description of the mechanism and for diagnosis and treatment.

Primary forehead presentations closely resemble the brow, but an internal examination will show the large fontanel behind the line of direction (Fig. 514). The configuration of the head is shown in Fig. 514, and the caput succedaneum over the vertex exaggerates the tower-like raising of the vault of the cranium. In the treatment of primary forehead presentations it must be remembered that often, in the beginning of labor, the forehead is to be felt at the inlet, but when the head enters, flexion occurs and the occiput comes forward, rotating anteriorly. By keeping the patient on the side on which the occiput lies, flexion and descent of the head are favored. King advises the squatting posture, claiming that the pressure of the thighs against the abdomen and uterus directs the position of the child. If it is



FIG. 514.—TOUCH PICTURE IN FOREHEAD PRESENTATION.

needed to exert pressure on the back of the child, the woman kneels on one knee, the other foot resting flat, and the corresponding thigh being pressed firmly against the abdomen, where the back lies (Fig. 654). Should the forehead not change its position, labor does not progress, and the case is to be treated as a brow presentation, with which, indeed, it is often confused in practice.

**Brow Presentation.**—Transitory presentation of the brow in the beginning of labor is occasionally observed, and as the head engages in the pelvis descent of the occiput occurs, and a more normal mechanism results. More frequently the deflexion is completed, and a face presentation is produced. Brow presentation is essentially pathologic, and if the child is normal or above normal in size, becomes very formidable. Small or macerated fetuses may pass through the pelvis spontaneously, though labor is usually difficult and much prolonged.

The frequency of brow presentation is variously given—perhaps once in 3000 cases is as near accurate as is possible to get. In the Moscow maternity brow presentation occurred 101 times in 130,768 labors. Its causes come under the general category of deflexion attitudes, but the frequency of contracted pelvis must be emphasized (in 45 per cent. of the above-mentioned cases), and this may explain, in part, the extraordinary difficulties encountered when the child is above normal in

size. The posture of the child is shown (Fig. 508). It will be noticed that the shape of the back is more marked than in forehead, but less than in face presentation, which, however, it closely approaches.



FIG. 515.—MECHANISM IN BROW PRESENTATION. BROW ROTATED.

*Mechanism.*—The point of direction is the brow, and although six positions theoretically possible, two are most commonly observed in nature—frontal



FIG. 516.—MECHANISM IN BROW PRESENTATION. BROW IN TRANSVERSE DIAMETER. NOT ROTATED.

anterior and frontodextra posterior. During the progress of labor, of course brow will be felt in other pelvic diameters, that is, it is found at any point of arc of rotation. Descent of the head is slow, and starts only after complete d

and, with the rupture of the membranes. Since the preparation of the cervix is poor, delay in the first stage is the rule. Unless the attitude is to change to either face or an occiput presentation, the brow descends in the middle of the pelvis, the head holding itself midway between flexion and extension. During the descent the frontal suture usually takes the transverse diameter and is synclitic (Fig. 516), unless the pelvis is flat. When the pelvic floor is reached, the brow rotates to the front, and the occiput to the hollow of the sacrum. The factors producing this rotation are the same as those operative in normal cases—the pelvic floor, the guidance of the converging rami pubis, and the accommodation of the fetal cylinder, which is easily flexible only in certain directions—to the bent birth-canal (Sellheim). In the brow attitude the fetal cylinder can bend best in its sagittal diameter. The sagittal diameter, therefore, is brought to correspond with the sagittal diameter of the pelvis. The brow, therefore, comes down and turns to the front until the face rests behind the pubis. In the rima vulvæ the brow, covered by a large caput succedaneum, first appears; then, under very strong expulsive pains, by a movement of flexion, the large fontanel, the vertex, and the occiput successively pass over the perineum, the nape of the neck coming to rest upon it, after which the eyes, nose, mouth, and chin come from behind the pubis with one movement. Sometimes the head is delivered up to the mouth before the occiput escapes,



FIG. 517.—TOUCH PICTURE IN BROW PRESENTATION (FR.D.A.).



FIG. 518.—MOLDING IN BROW PRESENTATION.

and, rarely, the head may escape with the frontal suture in the transverse diameter of the outlet; that is, internal anterior rotation has not occurred. It will be seen that the accomplishment of such a mechanism must be slower, harder, and more dangerous to mother and child than any other. The perineum is almost always lacerated, and often tears high up into the rectum, because the largest diameters are forced to the outlet. Clinically, it is very difficult, at this stage, to distinguish a brow presentation from terminal occipitosacral and forehead mechanisms. If the child is large, operation is almost always necessary to effect delivery.

**Diagnosis.**—Abdominally, the findings are the same as in face cases (*q. v.*). Internally (Fig. 517), the bregma is the lowest point, occupies the center of the pelvis, the large fontanel being palpable on one side, the root of the nose and orbital ridges on the other. The nose, mouth, and chin are high up, out of reach unless the patient is anesthetized, to allow deep insertion of the four fingers. The frontal suture runs in the transverse diameter or a little obliquely, and the amount of the facial

line which is palpable determines the degree of deflexion. In true brow presentation the nose is not to be felt, the orbital ridges being on a level with the posterior border of the large fontanel, the two demarcating the girdle of resistance.

Molding is characteristic (Fig. 518), the head having acquired a three-cornered outline. The face is flattened out, the distance from chin to top of forehead very great, and this is exaggerated temporarily by the large caput succedaneum.

The *treatment* of brow presentation must be active unless it seems certain that spontaneous correction will occur. To favor flexion the patient is put on the side to which the occiput points, but if this does not speedily bring about the desired result, it is best to correct the presentation under ether before the head engages and molding commences. Before the rupture of the bag of waters, nothing but the use of posture need be done. When the cervix is fully dilated, the membranes may be punctured, the head flexed and led into the pelvis either by the two hands or the forceps, after which the case is left to nature. (See Operative Obstetrics.) Should it be impossible to change the brow into an occipital presentation, which is most desirable, the attempt may be made to obtain a full face presentation, and, failing this, version is to be performed.

After the engagement of the head in brow presentation all manœuvres are rendered more difficult and dangerous. It is astonishing, however, what may be accomplished under deep anesthesia. When the abdomen and uterus are fully relaxed, it is often easy to push the head out of the pelvis, flex or extend it, and draw it back in proper attitude and position. Version at this stage is very risky, because the lower uterine segment is usually much stretched in brow cases, and, further, version is always to be avoided in primiparæ if possible. Should version be out of the question and manual correction fail, the attendant has two alternatives—a cutting operation, suprasymphyseal cesarean section or hebosteotomy, and expectancy, in the hope that strong pains will so mold the head to the pelvis that it will finally go through or can be delivered by forceps. If the child is large or the pelvis small, the latter process is not to be expected, and if the mother and baby are in perfect condition, the accoucheur should seriously consider the other procedures as primary operations.

What has been said acquires greater force in labors with the brow in posterior position. Here spontaneous delivery is impossible unless the infant is very small, which is also true of face presentation. Symphysiotomy has been performed by H. F. Lewis and Montgomery for the relief of dystocia due to brow presentation. Since some degree of pelvic contraction is frequent in such cases, symphysiotomy or even cesarean section must always be taken into consideration. Should nature's efforts suffice to bring the head well down onto the perineum, the additional power required for delivery may be applied by the forceps. (See Operative Obstetrics.) Forceps operations in brow cases are nearly always very difficult, and, should the hazard be too great, craniotomy is to be performed.

**Face Presentation.**—When the deflexion is carried to its highest degree, the full face comes to lie in the line of direction, or is bounded by the girdle of resistance and is felt by the examining finger. This is face presentation, and it occurs, in round numbers, about once in 200 cases. In face presentation the chin is the point of direction or denominator, and the six positions of presentation may, in individual cases, be distinguished. Mentodextra transversa is the most frequent, mentolæva anterior the next, mentodextra posterior, dextra anterior, læva transversa, and læva posterior in order. The various statistics show differing frequencies of the several positions, but, in general, face positions occur in the order of the frequency of the occipital positions from which they were developed; for example, since O.L.T. is the usual position which the head takes on entering the pelvis, the deflexion of the chin will bring the face down in M.D.T.

As a rule, face presentations are fully developed only after labor has been in

active progress for some time, and most often a brow presentation can be discovered early in the first stage, but in 3 cases I distinctly felt the full face lying over the inlet in the last month of pregnancy, an observation which was also made by LaChapelle, Nacgelè, Fieux, and others.

*Mechanism.*—Figs. 519 and 520 show the attitude or posture of the fetus in two of the common positions. The head is completely extended on the back, the forehead is flattened, and the occiput long drawn out. The neck is stretched; sometimes there are cracks in the skin from overstretching. The chest is protruded and is convex. The back is sharply incurved to receive the occiput, while the breech



FIG. 519.—FACE PRESENTATION. M.L.A.

is turned to the back. The fetus is lengthened, while its axis takes the shape of the letter S.

At the beginning of labor the head lies high, with moderate anterior asynclitism, the anterior malar bone and orbit being nearer the middle line and lower. Instead of flexion, as descent begins, we observe an exaggeration of the extension, the chin becomes more accessible, and the brow recedes a little. Descent occurs, with the facial line usually in the transverse diameter of the pelvis. In M.L.A. the chin points to the obturator foramen, that is, lies in the left anterior quadrant of the pelvis; in M.D.P. the chin points to the right posterior quadrant, and the facial line runs in the right oblique diameter of the inlet. Anterior rotation of the chin, the third movement, does not begin until the face is well applied to the pelvic floor and is brought about by the same factors as operate in O.L.A. The greatest flexibility of the fetal cylinder in face attitudes lies in the sagittal plane, but in a direction

opposed to that of occipital attitudes. In occipital presentations the fetal cylinder can accommodate itself best to the angular birth-canal by breaking at the fetal neck and the occiput bending backward—that is, extension occurring. In face presentations the same bending occurs, but reversed, and the chin flexes. In order, therefore, for the fetal cylinder to accommodate itself easiest to the birth-canal, it rotates so as to bring the chin forward under the pubis (Fig. 521). Anterior rotation must have begun before the face reaches the second parallel plane of Hodge, because the head, if normal in size, cannot enter the pelvis with the chin behind. This would bring the occiput and the upper chest and shoulder region into the inlet at the same time, and, under normal conditions, progress in this fashion would be



FIG. 520.—FACE PRESENTATION. M.D.P.

impossible. Under the exceptional combination of large pelvis, small child, and strong pains, labor may progress and terminate spontaneously with the chin posterior. Usually in those cases of spontaneous labors with the chin behind, the head entered the pelvis with the chin transverse or anterior, and, after engagement, the chin rotated to the hollow of the sacrum, the shoulders entering in one of the obliques. Further, mentosacral positions terminating happily for mother and child are so exceedingly rare that, for practical purposes, it is best to consider them as absolutely pathologic and as always requiring interference from art.

Anterior rotation being completed, or nearly so, the chin comes to lie behind the pubis near to the urethra, the forehead is behind the fourchet, and the occiput occupies the hollow of the sacrum. The fourth movement is not extension as in

.L.A., but flexion (Fig. 522), the hyoid bone of the fetus being applied to the anterior surface of the pubis, the chin, mouth, nose, eyes, forehead, and occiput



FIG. 521.—MECHANISM IN FACE PRESENTATION. FACE IN TRANSVERSE DIAMETER. NOT ROTATED.

appearing successively over the perineum, the chin flexing toward the sternum, but ending on top of the symphysis pubis. Internal anterior rotation may be completed



FIG. 522.—MECHANISM IN FACE PRESENTATION. FLEXION BEGINNING.

ly as the head passes through the vulva. External restitution occurs as usual, the in turning back to the position it occupied in utero, and delivery of the trunk takes place according to general principles.



Abnormal mechanisms can occur in the rotation. (1) Deep arrest of ro

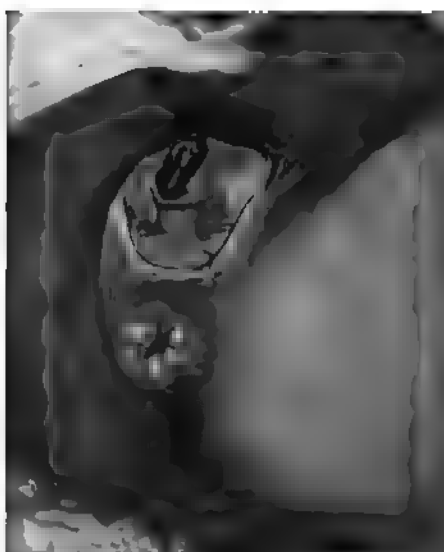


FIG. 523.—FACE APPEARING AT VULVA AFTER EPISIOTOMY.

Photograph. Wesley Hospital.

the face coming deeply into the pelv even pressing firmly on the perineu not turning to the front, the faci resting in the transverse diameter. favorable conditions—large pelvis child, relaxed pelvic floor (multipar: strong pains—the head may escape position, the flexion of the chin place over one descending ramus. Otherwise, unless aid is rendered, ceases, and both mother and child w (2) The second anomaly is where th remains at the sacro-iliac joint, o rotates into the hollow of the s. These are called persistent chin po positions, and are very form (Fig. 525). It has already been that the head cannot enter the pelv the chin behind, and it is easy to s difficult labor will be, should, after e ment, the mentum turn back towa sacrum. Then the broad occiput a chest must pass the inlet together.

is possible only under most favorable conditions. Rarely, nature terminate: cases, first, by anterior rotation even as late as this; second, by deliveri head as a brow presentation with posterior rotation, the occiput coming down from behind the pubis, and, third, the face is forced down and out in the abnormal position, without regard to the soft parts, which are torn most extensively in all directions. Should none of these occur and art be absent, the baby dies from asphyxia and the mother from ruptured uterus or exhaustion.

*Clinical Course.*—Labor in face presentation is usually longer—by three or four hours in primiparæ and one or two hours in multiparæ. Since the soft face does not press so hard nor so evenly as the occiput on the cervix, the pains are weaker, especially in the first stage. Dilatation of the cervix is, therefore, delayed, and this is often enhanced by the early rupture of the bag of waters, which is favored by the maladaptation of the presenting part on the cer-



FIG. 524.—FACE BEING DELIVERED.

Photograph. Wesley Hospital.

vix, allowing the full force of the general intra-uterine pressure to act on the membranes. The cause of the face presentation, for example, contracted pelvis, tumors, placenta prævia, may also be responsible for other anomalies. Engagement of the head is slow, but anterior rotation comes on suddenly and is usually quickly accomplished, as is also the delivery. Primiparæ less often have face presentations, and naturally in them the mechanism is slower and more arduous. Owing to the extreme lengthening of the fetal ovoid the lower uterine segment is put on the stretch, which must be remembered during the treatment.

*Diagnosis.*—Abdominally, the ovoid is longitudinal and very long, the flanks being quite flat. The shape of the uterus alone may sometimes suffice to make a diagnosis. Over the inlet the head is felt, and in the fundus the breech with small parts, the latter unusually easily outlined. It is often difficult to map out the



FIG. 525.—FACE PRESENTATION. CHIN ROTATED TO HOLLOW OF SACRUM.

back; what first impresses one as being the dorsal plane not having the proper consistence and not showing the triangular area pictured in Fig. 301. This is the chest of the infant, and in one case I could feel the child's heart beat, which has also been found by others. The back may occasionally be felt by deep pressure.

Above the inlet, to one side, is felt a hard, round prominence, the occiput, and this is separated from the back by a deep furrow. On the other side the inlet is empty, but if the patient is docile and the abdominal wall relaxed, with deep pressure the fingers may come upon the horseshoe-shaped jaw. Great importance is to be attached to the finding of the feet, the heart-tones, and the chest all on the same side. If on the other side, over the inlet, a large, hard prominence is felt with a sharp groove above it, the diagnosis of face, or at least brow, presentation is assured. The heart-tones are unusually loud.

Vaginally, early in labor the pelvis is empty, the bag of waters is large, square,

at least not of the watch-crystal form observed in occipital presentations. One can feel how it receives the full force of the uterine contraction during the pain. High up, even in primiparæ, and generally quite movable, the brow is felt, and also

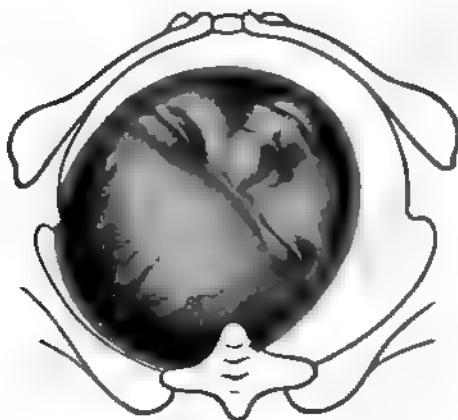


FIG. 526.—TOUCH PICTURE. FACE PRESENTATION. M.L.A.

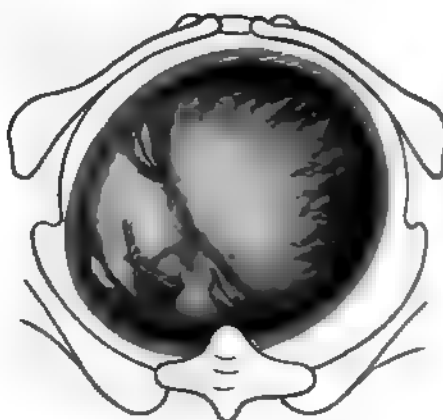


FIG. 527.—TOUCH PICTURE. M.D.P.

the anterior orbit, if not the root of the nose. As soon as the bag of waters ruptures there is usually no difficulty in recognizing the eyes, nose, mouth, and jaw. Only late in labor, when the caput succedaneum has disfigured the parts, does the face feel like the breech. An irregular surface, one with prominences and depressions,

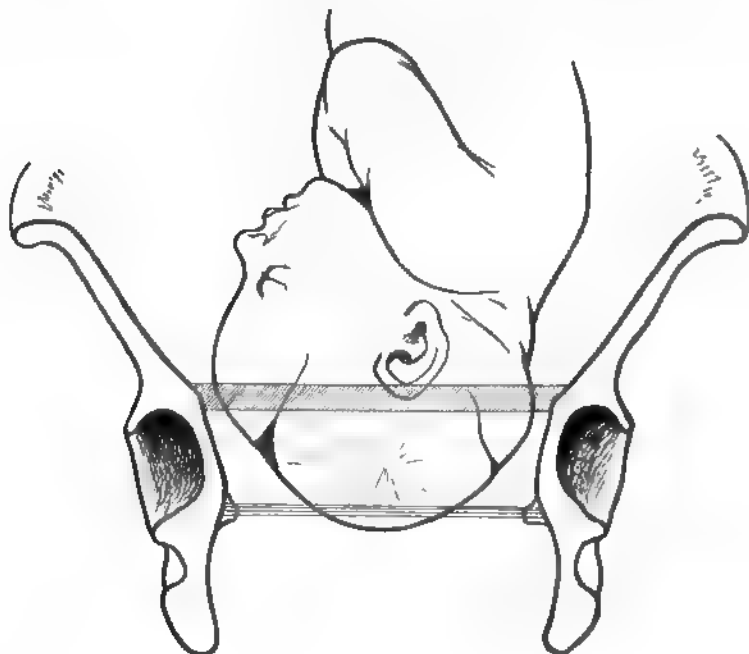


FIG. 528.—DIAGRAM. OCCIPUT ENGAGED.

is felt by the finger, which at once notifies the examiner that the vertex does not present. The facial line lies in the transverse or the oblique diameter (Figs. 526 & 527), turning as rotation progresses. In differential diagnosis breech presentation, brow, and lesser degrees of deflexion, and anencephalous monsters must be

considered. Any practitioner who will hold the possibility of such confusion in mind will easily avoid errors. If the face is so swollen that the landmarks are

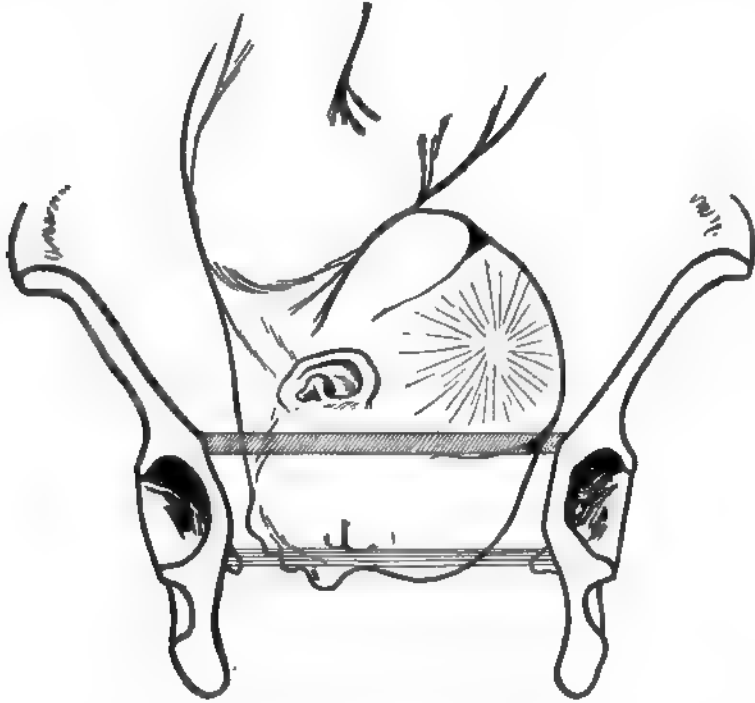


FIG. 529.—DIAGRAM. FACE NOT YET ENGAGED.

obliterated, two points will always remain—the saddle of the nose and the gums. If the child is alive, it may suck the finger. An important point in the diagnosis is the determination of the degree of engagement. The head is engaged only when the biparietal diameter has passed the inlet. In occipital presentations the parietal bosses have just sunk below the plane of the inlet when the lowest part of the head, the vertex, comes to lie in a line drawn from one ischiatic spine to the other. In face presentation, however, when the brow or the root of the nose, that is, the lowest portion of the presenting part, comes to lie in this line, the parietal bosses are still several centimeters above the plane of the inlet (Figs. 528 and 529). Only when the face is deep down on the pelvic floor may we say that the head is engaged.

When making internal examinations in face cases great care is to be taken to avoid the introduction of vaginal mucus into the eyes of the child. If gonorrheal, a blinding ophthalmia may thus be caused. Similar precautions are advisable with the use of antiseptic



FIG. 530.—FRONT VIEW OF CHILD DELIVERED IN FACE PRESENTATION. SHOWS CRACKS IN SKIN OF NECK. Chicago Lying-in Hospital

solutions. Rectal examination often suffices for the diagnosis, but usually doubt exists and a vaginal is necessary.

*Plastic Changes.*—If the labor has been prolonged after rupture of the membranes, the face is horribly disfigured (Figs. 530 and 531). Over the anterior cheek and eye the caput is always found, and the whole face is involved, the eyes bulge out, the lids are swollen, a mucoserous discharge escaping from them; the mouth is held open by the tumid lips, the tongue sometimes protrudes, and the child may not be able to nurse for several days. Minute hemorrhages under conjunctiva and skin, sometimes with bullæ, intense venous congestion, the tumefaction of the thyroid,



FIG. 531.—CHILD DELIVERED IN FACE PRESENTATION.  
Chicago Lying-in Hospital.

and the cracks in the skin of the neck already mentioned, give the child a most discouraging appearance. The shape of the head is extremely dolichocephalic, the occiput being long drawn out, and there may even be a saddle-shaped depression near the large fontanel. The child lies in its crib on the side, with the head extended, the back straight, and may keep this attitude for at least two weeks. The mother may be reassured that the child's features will soon regain their proper appearance.

*Prognosis of Face and Brow Presentations.*—Without question both face and brow presentations must be considered pathologic. The mortality is higher in both because of the longer labor, the greater danger of infection, the frequently necessary operative interventions, and also those unnecessarily undertaken. While the majority of face cases will terminate spontaneously or with a little help from art, brow presentation is always dangerous.

For the child the mortality is also higher, which is due to—(1) Prolonged labor and cerebral compression; (2) compression of the neck against the pubis, interfering with the return circulation from the head; (3) compression of the trachea and larynx against the pubis, with suffocation or even fracture; (4) injury from forceps or other operation, done to effect delivery. Fully four times as many children die from face presentation as in occipital, and fully ten times as many in brow. It would be interesting to follow up these children to see if the extreme molding which the brain suffered affects their mentality in any way in later life.

*Treatment.*—Not all face presentations require special treatment. The majority terminate spontaneously and happily for the mother and babe, without

assistance of art. Moschion (A. D. 100) recommended that all such presentations be changed to occipital; Mauriceau (1663) and de la Motte (1721) taught the . . . Paul Portal (1685) and Deleurye (1770) took the opposite side, and left to nature. Baudelocque (A. D. 1810) advised immediate interference, a thing which is still felt, in spite of the efforts of modern obstetricians to dispel. Perhaps the fact that Hodge, and more recently Schatz, recommended it, does not explain the present frequency of operative measures in face cases. In 1791 Zeller, from 40 cases, and in 1791 Boër, in Vienna, from an experience of 80 cases, showed that these presentations may safely be left to nature, 79 of Boër's 80 having terminated spontaneously with only 4 fetal deaths. Jaggard, of Glasgow (died, 1896), declared in the strongest terms that watchful expectancy should be the treatment of face presentation. No one nowadays claims that it is the practice to correct every face presentation, but when the cases are carefully selected, many will be found where the interests of mother and child are best served by early interference.

*Before Engagement.*—If discovered during pregnancy or early in labor, it may be possible to alter the attitude of the child by Schatz's method of abdominal palpation. During labor all measures which preserve the bag of waters are employed, for example, the side position, abstention from bearing-down efforts by the patient, and care during examinations by the accoucheur. It may be very advisable to put a colpeurynter in the vagina, filling it moderately. If the child is found in transition from vertex to face, the woman should lie on the side which the occiput points; if the face presentation is fully formed, she should lie on that side which will favor descent and anterior rotation of the chin, that is, the side to which the chin points. As a rule, in the absence of special indications, watchful expectancy is the treatment to be pursued, and the general practitioner should do best for his patient if he gives her plenty of time to force the head well down the pelvis and onto the perineum. Then he may wait as long as six hours for spontaneous delivery or sufficient descent and anterior rotation that the forceps may be easily and safely applied.

If the position is one with the chin in the transverse diameter, or, better still, in the anterior quadrants of the pelvis, this is the invariable treatment, in the absence of other indication, but if the chin is posterior to the transverse diameter of the pelvis, a more active conduct may be advisable, in the interests of the child in the hope of reducing the length of the labor and its attendant distress and dangers. If the head remains high with the chin posterior, in spite of good pains, malpresentation may be changed manually to one of the occiput, or podalic version may be performed. There is no unanimity of opinion among the authorities regarding the selection of these procedures. Baudelocque, Schatz, Thorn, and Hodge prefer the manual correction, as do most modern writers. Bumm is an exception. The writer has had almost uniform success with the conversion of face presentation to occipital, the only cases in which his efforts failed being those in which labor had progressed too far, extreme molding of the head had taken place, and the uterus had become strictured around the child's neck. Chin posterior positions are particularly favorably altered by conversion into occiput presentations, because an anterior occiput is obtained, for example, M.D.P. becomes M.L.A., and M.L.P. an O.D.A. (For the methods of manual correction see Chapter XX.) Should it be impossible to correct the presentation, podalic version may be attempted, and, failing in this, craniotomy would be necessary.

*After Engagement.*—When the head is engaged in the pelvis with the chin in the transverse diameter or even anterior to it, given a strict indication for delivery, cesarean section is the operation of choice. Before applying the instrument an attempt is made to complete the rotation of the chin to the front by manipulation with

the fingers or half hand. A purchase is obtained on the posterior malar frontal bones, and, during the pains, the fingers make gentle traction upward forward, trying to bring the chin under the pubis, aiding the manœuvre by pressure on the occiput from the outside over Poupart's ligament. Occasionally a pressure on the chin to exaggerate extension and slight traction forward will aid rotation. If rotation can be thus completed, nature may terminate the case, at least, the forceps operation becomes at once easier, simpler, and safer.

Should the chin lie behind the transverse diameter, or have even turned toward the sacrum, the family is to be advised that, with the usual methods of delivery, a dead child is almost a certainty, and if the mother and child are in prime condition the question of cesarean section is to be considered. When the conditions are ideal for an abdominal delivery, the accoucheur should try to change the position of the fetus from the posterior to an occiput anterior, even though the head is engaged. Under general anesthesia so much relaxation of the uterus occurs that a surprising degree of mobility is conferred on the fetus. It is then possible, and if it is done gently it is safe, to push the head up and out of the pelvis sufficiently far to enable the author's method of manual conversion to be practised. Occasionally the conversion may be effected by means of vulsellum forceps. Naturally, the operation requires the greatest circumspection, but the end will justify the risk, and the latter is very little in competent hands. If conversion fails or appears too hazardous, manual rotation of the chin through an arc of three-fourths of the half-circle is to be attempted. Unless the chin can be brought into the anterior half of the pelvis, forceps are a most dangerous and destructive instrument, being at the same time inefficient. Craniotomy is a more humane operation, and has hardly a higher fetal mortality than the forceps used in such instances. Hodge lauds the use of the vectis in such cases, but modern accoucheurs hardly know the instrument. In the treatment of face presentation the forceps are to be employed only when absolutely unavoidable. Before doing a craniotomy on a living child with the chin posterior a gentle attempt with the forceps is justifiable, but it must stop short of maternal injury. For impacted cases pubiotomy has been recommended. In all face deliveries, spontaneous and operative, the fact must be remembered that the diameters and circumferences presented to the pelvic floor outlet are not so favorable as in occipital deliveries, and that the pelvic floor is pushed further downward and torn from its attachments. Deep episiotomy, sometimes going through the pillar of the levator ani, is almost always needed, and is to be strongly recommended. After the conversion into an occipital presentation, unless there is an urgent indication for delivery, the case should be left to nature. A spontaneous delivery may now occur—events the head will be molded by a few hours' labor into a favorable shape and brought low into the pelvis, sometimes even onto the perineum, making the eventual forceps delivery easy and safe.

Every face and brow case demands a comprehensive diagnosis of all adjacent conditions which may govern the methods of treatment. As such may be the contracted pelvis, placenta prævia, tumors, eclampsia, etc.

It is advisable to observe the children carefully for several days, since edema of the glottis may occur. Fracture of the larynx has resulted from too great pressure of the trachea against the pubis, a point worth remembering while conducting the delivery. The scratch-marks on the face require antiseptic treatment. The tumefaction of the eyelids will subside quickly under a warm boracic solution dressing.

## CHAPTER L

### ANOMALIES OF THE PASSENGERS (Continued)

#### BREECH PRESENTATION

IN about 3 per cent. of cases the child presents itself for delivery with the breech as the advancing portion of its body. Most authors consider breech presentations eutocia, but since the fetal mortality is three times as high as in O.L.A., and the maternal morbidity, from lacerations and sepsis, decidedly greater, the author believes, with Eden and others, that they should be considered dystocia.

Breech presentation is the first of the errors of polarity of the fetus to be discussed, the normal polarity being a parallelism of the fetal axis with the long axis



FIG. 532.—BREECH PRESENTATION. S.L.A.

If the mother, the cephalic pole presenting at the inlet. Reversal of the normal polarity is breech presentation; lack of parallelism between the two axes produces the varieties of transverse presentation.

**Etiology.**—Little is positively known of the causes, because neither the mother nor the babe may show anything unusual, but the presentation has been more frequently found in the following conditions: (1) Abnormally shaped uteri, especially uterus arcuatus and subseptus; (2) anything that will prevent engagement of the head, as contracted pelvis, tumors, low insertion of the placenta, the most



frequent cause; (3) polyhydramnion, the child being very free to move around; (4) multiparity, which acts in the same way; (5) on the part of the fetus, head-



FIG. 533.—BREECH PRESENTATION S.D.P.



FIG. 534.—SIMPLE BREECH PRESENTATION

two are mostly observed,—S.L.A. and S.D.P.,—though in the latter usually the back tends somewhat more to the side than behind. The point of direction is the sacrum, and in following the mechanism of labor the genital crease is used for the purpose of orientation, in the same way that the facial line and the sagittal suture are used for other presentations.

*Mechanism of Breech Presentation.*—With very little variation the mechanism of labor is the same whether the complete breech presents or there is an error of attitude, as footling or single breech. For purposes of study *sacrospina anterior* (S.L.A.) will be selected. The movements of the breech and lower trunk, of the shoulders and of the head, must be considered, those of the shoulders and head being more constant and important.

Even in primiparae the breech remains high up until labor is quite well advanced, often until dilatation of the cervix is completed and the bag of waters ruptured. The feet accompany the buttocks, but at a slight distance, being held back by the cervix or pelvic brim. *Descent* is slow in primiparae because the soft breech cannot

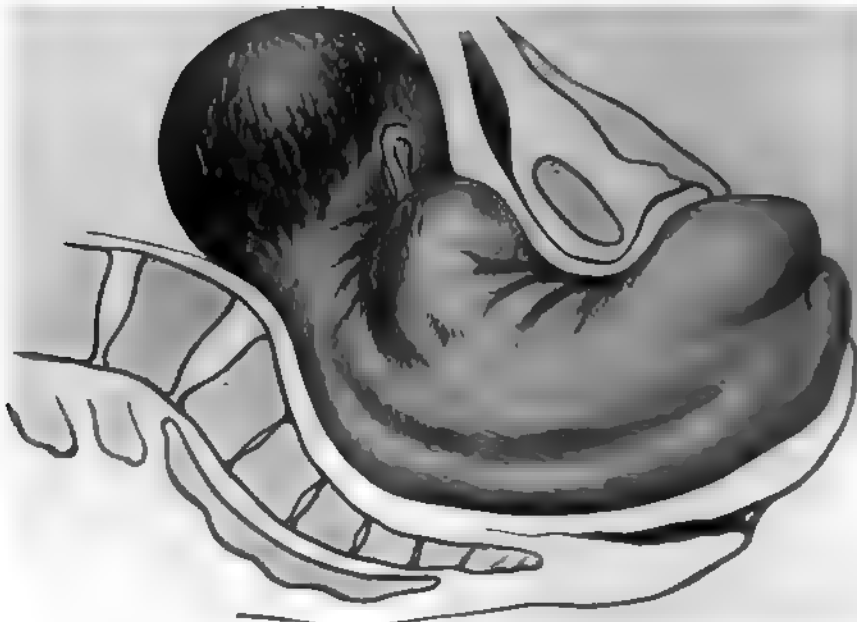


FIG. 536.—MECHANISM OF BREECH LABOR. S.D.P. LATEROFLEXION AT OUTLET.

wedge itself into the vagina so firmly as does the head, and, further, when the head presents, the upper vagina, the cervix, and the bases of the broad ligaments, with the pelvic connective tissues, are already dilated and prepared by the descent of the broad cephalic wedge in the latter weeks of pregnancy. *Flexion*, the second movement, takes place as soon as the breech strikes the perineum; the posterior buttock is held back; the anterior one stems under the pubis (Fig. 536). This movement is always associated with the third—*internal anterior rotation*. In S.L.A. the breech descends in the left oblique, that is, the bisiliac diameter lies in the left oblique diameter of the pelvis, the genital crease lying in the right, the anterior hip pointing to the right iliopectic tubercle, and being a little lower than the posterior. This is anterior asynclitism, and is analogous to the obliquity of Naegele. Anterior rotation occurs by the anterior hip rotating to the front from the right anterior quadrant of the pelvis, the sacrum looking directly to the left side, the other buttock turning behind, the genital fissure now lying in the transverse. The causes of this movement are the same as in the other presentations (*q. v.*). The fourth move-

ment is continued *lateroflexion*; the anterior hip stems under the pubis, the posterior hip rolls over the perineum, the whole pelvis rising up over the pubis, a tight pelvic floor increasing this elevation. *External restitution*, the fifth movement, is not constant. Usually the anterior hip turns again to the right side, and the sacrum comes directly anterior, but sometimes the back remains in the transverse position and the shoulders come out in this position. Now the legs drop down and the back again lies in the oblique (Fig. 537).

The movements of the shoulders are precisely similar to those of the breech. Descent occurs with the bisacromial diameter in the left oblique. If no attempt at aid delivery by traction from below is made, the arms lie folded closely against the chest. Stronger pains and more abdominal muscular exertion are needed for delivery of the shoulder-girdle. The anterior shoulder rotates in the right anterior quadrant of the pelvis toward the pubis and stems behind it, while by a process of *lateroflexion* the posterior shoulder and arm are delivered. Then comes the anterior shoulder from behind the pubis, and if no assistance is given, the body drops down with the neck against the perineum, the nape against the subpubic ligament.

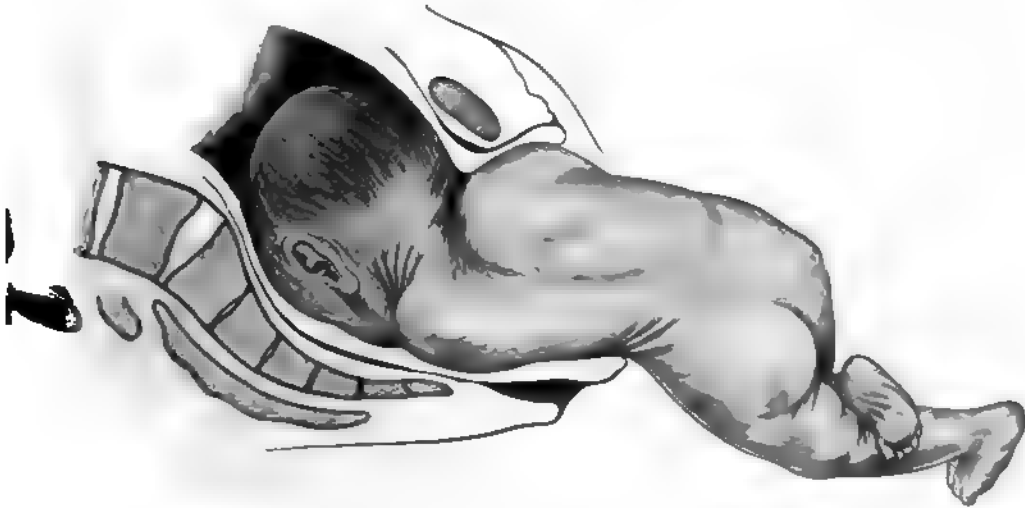


FIG. 537.—DELIVERY OF BREECH TO NAVEL. S.D.P.

If the head is arrested high, the fifth movement, *external restitution*, now takes place, the back rotating again to the side. If the head follows the body closely and sinks into the pelvis, the back may rotate to the front.

When the shoulders are passing the vulva, under normal circumstances the head has entered the inlet. If the inlet is contracted, the head is held back, and the stretching of the neck permits the escape of the shoulder-girdle, but not completely, unless the soft parts are pushed back a little around the fetal neck and up into the bony pelvis. When the head is well flexed on the sternum, the same diameters are opposed to the girdle of resistance as in O.L.A., but in inverted order. A difference is also seen in the shape of the wedge—in occipital presentation the blunt occiput advances; in head-last deliveries the narrow planes from the neck to the biparietal go first, a fact which explains in part why the head goes through the pelvis easier and quicker when it comes out last. Descent, flexion, anterior rotation of the occiput to the front, occur in order (Fig. 538), all explained by the usual mechanisms. The sagittal suture enters in the right oblique, just as it does in O.L.A. When the chin has rotated to the hollow of the sacrum, *flexion*, the fourth movement, occurs, the nape of the neck being the center, and the chin, face, and

forehead coming successively over the perineum, after which the occiput escapes from behind the pubis.

In back posterior positions the mechanism is nearly the same. Here the anterior buttock must rotate three-fourths of the half-circle in order to get under the pubis, after which the mechanism is as above described. It has happened in some cases that the back rotated in front of the sacrum to the opposite side, and before delivery is completed has traversed three-quarters of the circumference of the pelvis. I have never seen this occur except when the posterior foot and leg had prolapsed and had guided this abnormal rotation (*vide infra*).

*Unusual Mechanisms.*—Occasionally, after the breech is delivered, the body rotates beyond the pubis to the other side of the pelvis, an over-rotation, which has likewise been observed in the mechanism of the shoulders in head cases. The remainder of the child may come out with the back on the side opposite that by which it started. Even excessive internal anterior rotation of the breech has been observed, the body of the fetus issuing with the belly to the pubis. Subsequently

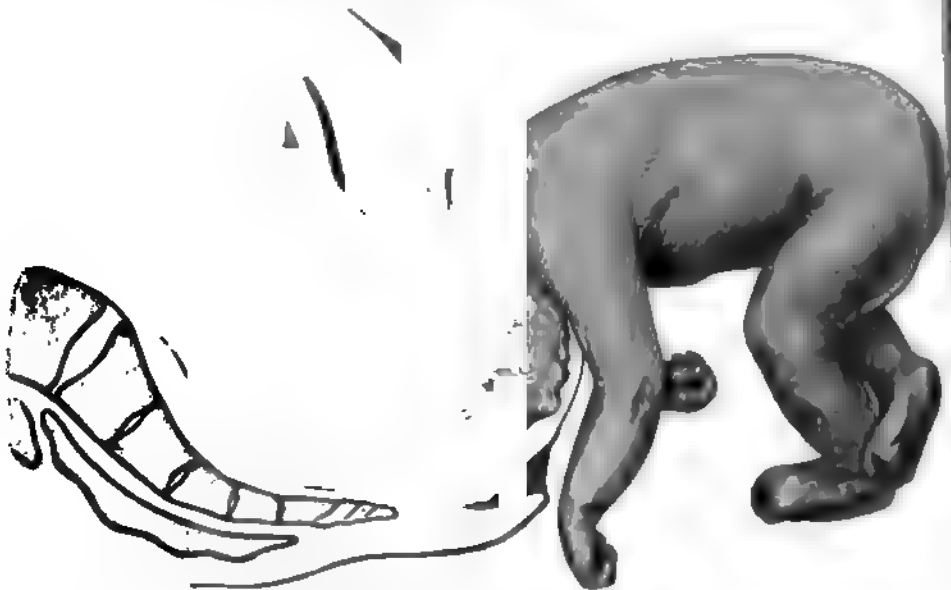


FIG. 538.—DELIVERY OF AFTER-COMING HEAD IN FLEXION.

the shoulders enter in an oblique diameter and the proper mechanism is resumed. It is not usually possible to discover the cause of these irregular mechanisms.

Footling presentation has the normal mechanism, unless by chance the posterior foot has prolapsed. In all labors the tendency is for the lowest portion of the presenting part to slip under the pubic arch. The construction of the front part of the pelvis and the arrangement of the sacrospinous ligaments and the levator ani, resemble the ways of a ferry-boat, and any movable body placed on these inclined planes, propelled from above, would tend to go in this direction. Thus the breech, when the anterior leg has prolapsed, glides without difficulty along the ways. It is different, however, when the posterior leg has prolapsed. Here the breech is held higher, the anterior buttock impinges on the horizontal ramus of the pubis, and the posterior leg is prevented from reaching the anterior inclined plane. It finds an easier way on the other side of the pelvis, and often, not always, as some authors claim, the back rotates in front of the sacrum, the posterior limb now becoming anterior and following out the favorite mechanism, but on the other side of the pelvis. This mechanism might also be explained on the theory of Sellheim. The anterior

\* **limb** fixes the lower trunk so that it cannot bend easily toward the front, but does so toward the sacrum. Rotation then takes place in the direction in which the fetal cylinder can most readily bend. After the breech is on the other side of the promontory, lateroflexion of the fetal spine is most favored in an anterior direction, and, therefore, the fetal cylinder rotates anteriorly to accommodate itself to the birth-canal. In several instances I have observed the usual mechanism, anterior rotation, even though the posterior limb had been brought down.

Abnormal rotation of the back is infrequently observed, unless the accoucheur is hasty and makes premature traction on the trunk, or ignorantly interferes with nature's methods. If the back does not rotate to the front, but to the sacrum, the child descends with the belly to the pubis of the mother. Usually the natural powers are insufficient to deliver the infant in this position, and art has to aid. (See Chapter LXXI.) Nature may accomplish the birth, the shoulders being forced out in the transverse, the elbows and arms falling from behind the pubis, and anterior



FIG. 539.—DELIVERY OF AFTER-COMING HEAD WITH OCCIPUT POSTERIOR. FIRST MECHANISM, CHIN FLEXED.

rotation of the trunk is effected late. As a rule, the head gives the most trouble. If it turns with the occiput in the hollow of the sacrum, the chin to the pubis, labor may stop, and unless art aids the infant will perish. Nature sometimes terminates these cases in one of three ways: (1) If the head comes down well flexed, the chin applied to the sternum, anterior rotation of the occiput may occur very late. Usually in these instances the occiput did not lie directly behind, but more to one side. (2) If the head is flexed (Fig. 539), delivery with the occiput posterior occurs, the root of the nose stems behind the pubis, the nape of the neck, occiput, and vertex coming over, or through, the perineum, the face then falling from behind the pubis. This mode of delivery is facilitated by lifting the child up. (3) If the head is extended, the chin may catch on one pubic ramus (Fig. 540). Artificial aid is almost always necessary here. By lifting the child up the occiput, vertex, and forehead in order may pass over the perineum, the neck forming the center of rotation. Nature, however, alone cannot do this; the trunk depends, and the occiput must

come over the perineum, pulling the face after it, which can seldom be accomplished quickly enough to save the infant.

Single breech presentations have a more laborious delivery, because the legs, extended against the body, act like a splint and rob the fetal cylinder of its flexibility. Descent and flexion are, therefore, very slow and difficult. To be considered also are the smallness of the advancing wedge, which results in imperfect preparation of the soft parts, and delay and danger in the passage of the shoulders and head; the frequency of the early rupture of the bag of waters, and the usually weak labor pains, because no firm body presses on the cervical ganglia.

Labor may be complicated by the arms leaving the chest and being stretched up over the head, or even crossed behind the occiput in the nape of the neck. Nature cannot terminate these cases satisfactorily. Art must step in. (See Chapter LXXI.)

**Clinical Course.**—During pregnancy breech presentations sometimes cause symptoms which attract attention. Pain and distress in the epigastrium may be complained of, and if the fetus changes its position, these will be relieved. Pendulous

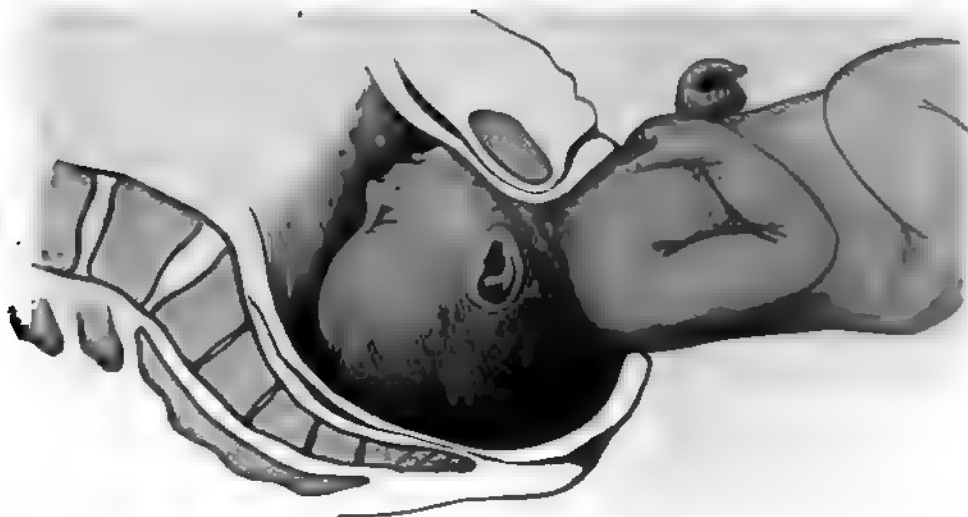


FIG. 540.—DELIVERY OF AFTER-COMING HEAD WITH OCCIPUT POSTERIOR. SECOND MECHANISM, EXTENSION.

abdomen is common. Lightening does not occur. The fetal movements are perceived low in the belly in the iliac regions.

Since so many small and premature children come by the breech, the time of labor is shorter than with cephalic presentations, but, counting only full-sized infants, labor is actually longer in breech cases, and this is especially true of primiparæ. This increase of the length of labor is all in the first stage, the second stage progressing very rapidly, seldom taking more than eight minutes, and usually less than four. The breech remains high and relatively immobile until the cervix is completely dilated; then, with the rush of the waters, it comes quickly down to the perineum. The actual delivery is shorter and less painful than head labors. Premature rupture of the membranes is common, and this renders still slower the dilatation of the os. In primiparæ labor may be very tedious, and the second stage, owing to rigidity of the vagina and perineum, may be so prolonged that the life of the fetus is much endangered. In cases of complete breech the large foregoing part prepares the cervix and pelvic floor for the passage of the head. In footling or single breeches these parts are poorly dilated, and while the slender trunk slips through easily, the head is almost always arrested, the child's life being lost, or the tissues being torn as a result. Meconium may escape freely during breech de-

liveries, but it has no significance unless it shows before the breech has engaged or other signs of intra-uterine asphyxia are present. It has the same cause as the



FIG. 541.—HEAD FROM CESAREAN SECTION. NOT MOLDED.

formation of the caput succedaneum; the meconium is pressed out in the direction of the least resistance, which is the anal region lying over the os.

In the third stage of breech labors complications due to anomalous separation

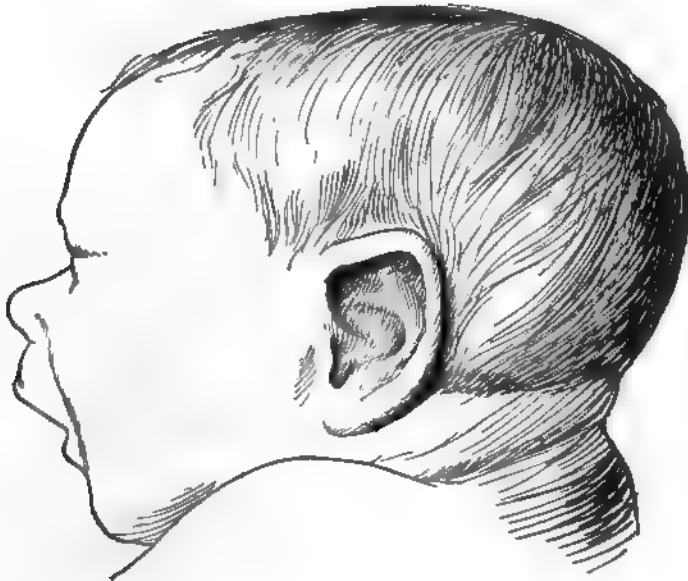


FIG. 542.—HEAD FLATTENED ON TOP. BREECH PRESENTATION IN A PRIMIPARA (Hecker).

of the placenta occur, also a tendency to atony of the so rapidly emptied uterus. Postpartum hemorrhage is, therefore, slightly more frequent than usual, and the rôle of lacerations must also be considered in this connection.

**Plastic Changes.**—The caput succedaneum is found on the anterior hip, but may spread all over the buttocks. In boys the penis and scrotum may be enormously edematous and black and blue from extravasated blood. In girls there may



FIG. 342.—HEAD FLATTENED ON SIDE. BREECH PRESENTATION.

be a moderate vulvitis, with leukorrhea, for a few days. If the leg has been down for any length of time, it swells and shows minute hemorrhages besides the severe congestion. All this disappears within a week. Ordinarily, the child's head is not molded, but presents the round shape it had in utero—this in multiparæ and when the breech presentation was developed just before labor began. If the child had lain a long time in this position, especially if the mother was primiparæ, or if the labor had lasted a long time after the rupture of the membranes, distinct evidences of molding will be discoverable on the head. This may take the form of a dolichocephalus, which was especially brought out by Fritsch, the head having been pressed down by the fundus uteri or one or the other side of the head may be flattened. If the mother had a pendulous abdomen, the side of the head which lay posterior will show the flattening, as in this case the head will be inclined toward the anterior shoulder. If the abdominal wall held the head up firmly, the side of the head which lay anteriorly will be flattened, the lateral inclination then being onto the posterior shoulder. The sternocleidomastoid and other muscles on the side opposite that showing the flattening may be shortened, producing a wry-neck. In cases of oligohydramnion this is the rule. Great importance must be attached to this congenital shortening of the neck muscles, because if, during delivery, too much traction is made on them, they will tear, hematoma or myositis resulting. Permanent wry-neck, while seldom due to injury of a normal muscle, and seldom following a hematoma of the muscle, is often the result of this congenital shortening, either with or without injury.

**Diagnosis.**—Unless labor is advanced and the pains are very strong and frequent, rendering the uterus rigid, the external examination will be sufficient for diagnosis. The ovoid is longitudinal, but the upper portion of the uterus is broader than the lower and runs to the side on which the head lies, a three-cornered effect being produced. Over the inlet no hard, round body is to be found, but, instead, a soft, yielding, irregular mass which glides upward from between the hands, leaving

be a moderate vulvitis, with leukorrhea, for a few days. If the leg has been down for any length of time, it swells and shows minute hemorrhages besides the severe congestion. All this disappears within a week. Ordinarily, the child's head is not molded, but presents the round shape it had in utero—this in multiparæ and when the breech presentation was developed just before labor began. If the child had lain a long time in this position, especially if the mother was primiparæ, or if the labor had lasted a long time after the rupture of the membranes, distinct evidences of molding will be discoverable on the head. This may take the form of a dolichocephalus, which was especially brought out by Fritsch, the head having been pressed down by the fundus uteri or one or the other side of the head may be flattened. If the mother had a pendulous abdomen, the side of the head which

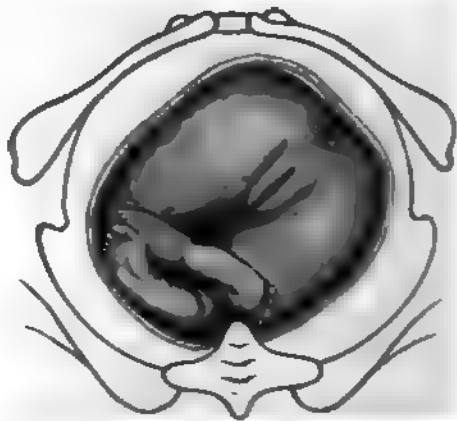


FIG. 344.—TORCH PRESENT. COMPLETE BREECH. S.L.A.



the inlet empty, and the hands to come almost together. In the fundus the head is usually easily felt, under either the liver or the spleen. If it is in the middle line, the examiner may surmise that the body of the child is straightened and that the cause of the extension may be the legs, stretched up toward the face—that is, single breech presentation. On one side the back is felt, and the shoulder is usually easily outlined above the navel and median. Between the shoulders and head a deep sulcus is found. The heart-tones are loudest on the side where the back lies, and are always above the level of the navel, an important diagnostic point. Often the head can be grasped between the two hands, or even measured with a cephalometer, but other times it can be felt only by tapping-palpation—and occasionally it is to be recognized as a body showing ballottement. *Rectally*, the diagnosis may often be made, using the points about to be mentioned. If any doubt exists, however, a vaginal examination is needed. *Vaginally*, the fingers have to be deeply inserted before the presenting part can be touched, the pelvis being empty. A convex hard tumor in the vaginal vault is not felt; instead, a roundish, soft mass of prominences and depressions, in which the examiner can distinguish the buttocks with a crease between them, and at one end a pointed bone—the sacrum. Three or four small prominences on this will identify the bone and show the direction of the pelvis, but for additional assurance the finger may follow the genital crease to the child's genitalia, when the scrotum or vulva will be distinguishable. The finger at the anus may feel the tuberosities, and, if inserted, may be covered with meconium, of course, after the membranes are broken. Higher up and to one side one or both feet may be felt, though usually only the heels are within reach of the finger. Suspicion having been aroused by the empty pelvis, the accoucheur ought to have no difficulty in recognizing the breech, but mistakes are very common, the breech being confused with the shoulder, the face, and the bag of waters. The closed axilla and the costal gridiron will identify the shoulder, and the saddle of the nose and orbital ridges, the nostrils, and the gums, will prove the face. The diagnosis of the position of the breech is made from the location of the sacrum. It is advisable not to introduce the finger into the anus or into the vulva of the fetus.

In single breech, when the feet are extended up to near the face, they may often be felt there from the outside. The uterus is longer and straighter compared with the rounded outline when the child is normally flexed. *Vaginally*, the feet cannot be felt; the anus is nearer the middle of the pelvis, and the straightened thighs disclose the direction of the extremities.

In footling the accoucheur should follow the prolapsed extremity up to the pelvis and make the diagnosis on general lines, the direction of the big toe and the flexure of the knee giving added information. One should not hastily conclude that a breech presentation exists when the foot is discovered—it may have prolapsed with the head.

**Prognosis.**—Statistics give the maternal mortality as slightly higher than in occipital presentations, the reasons being: (1) Labor is longer and internal examinations are more frequent, both increasing the dangers of infection; (2) effacement and dilatation of the cervix are not so perfect, hence lacerations are more common; (3) since the head comes rapidly through the unprepared pelvic floor, rupture of the perineum is frequent, extending often through the rectum, and these are not always errors of art; (4) disturbances of the mechanism of labor are frequent, and since they demand the introduction of the hand or other operative measures, the prognosis for the mother is doubtful; (5) postpartum hemorrhage is increased. Most of these dangers may be eliminated, and all may be minimized by the application of the rules of good obstetrics.

For the child, breech presentation is certainly dangerous, the mortality tables showing from 6 to 15 per cent. of deaths. With proper treatment, not over 5 per cent. of children should die in uncomplicated cases. Asphyxia causes most of the deaths, but fracture of the skull and injuries to the neck and spine also account for

many of them. The asphyxia is caused by compression of the cord between the body and the cervix after the breech is born, or by its being stretched upward from between the child's legs, by premature detachment of the placenta, by compression of the placenta by the hard head, and by delay in delivery due to rigid soft parts. In vertex presentations the soft breech lies against the placenta and exerts no compression, and if the placenta loosens before the delivery of the trunk, the head is already out, or nearly out, so that the child may breathe, whereas in breech presentation the first inspiration sucks in liquor amnii, blood, or anything which lies near the mouth. It is possible, too, that the cold air striking the body, or the manipulations of the attendant, excite premature respirations. A child will live five to ten minutes after the breech is delivered, there being very few cases on record where a child was born alive fifteen minutes after the breech passed the vulva. It is advisable, therefore, not to allow the progress to be too slow after the breech has passed the vulva; on the other hand, undue haste must be avoided because of the danger of injury to the fetal person. Fracture of the femur, of the pelvis, rupture of the filled colon, of the liver, fracture of the humerus, of the clavicle (common), overstretching of the cervical spine, even fracture of the spine, pulling the nerves out of the spinal cord (Erb's paralysis), rupture of the sternocleidomastoid, dislocation of the atlas—all these and more have been observed. In old primiparæ or such parturients as have rigid soft parts, these dangers are augmented and require special treatment for their prevention.

**Treatment.**—If breech presentation is discovered during the last few weeks of pregnancy, it is advisable to make gentle efforts to bring the cephalic pole over the inlet. The patient is instructed to assume the knee-chest posture several times daily, and, when reposing, to lie on that side to which the head points; for example, in S.L.A. on the right side. The accoucheur may also try, by gentle external manipulation, to bring the head down, though his efforts are not always rewarded by a permanent change of the presentation.

*Watchful expectancy is the treatment during labor.* Older writers usually advised version, changing the breech to cephalic presentation by internal and external manœuvers, and especially in old primiparæ. While admitting that a head presentation is highly desirable, and particularly in aged primiparæ, unfortunately the operation in them is more than usually difficult and unsuccessful. Lately cesarean section is advanced as the treatment of breech presentation in primiparæ. In the absence of other complications—very large fetus, contracted pelvis, etc.—the author does not approve of this, nor does McPherson, after a study of the large material of the New York Lying-in Hospital.

Where the soft parts appear very rigid, and when the child is large, it is wise to prepare the former for the rapid stretching they are about to receive. This is done by colpeuryesis, a Carl Braun colpeurynter being placed in the vagina and filled with 12 to 16 ounces of weak antiseptic solution. By the stretching it causes, and by its presence, the pains are strengthened, the tissues softened and dilated, and if it is expelled by the powers, the pelvic floor outlet is enlarged as by the passage of the first twin. Another favorable action of the colpeurynter is the preservation of the bag of waters, which is so highly desirable in breech cases.

Otherwise the treatment of the first stage is not at variance from the usual. When the second stage draws near, the accoucheur should have everything ready for all the emergencies of an operative delivery. This provision consists of a set of instruments—forceps, perineorrhaphy instruments, etc., hot bath, towels, and tracheal catheter for treating the asphyxiated child, a table on which to place the parturient for delivery, and sufficient assistants. (To avoid repetition, the reader is referred to the chapter introducing the subject of Operative Obstetrics.)

When the breech begins to distend the vulva, the woman is placed on the table, her limbs supported by assistants, and, in the absence of trained help, by courageous neighbors—not the husband, as he is likely to faint. As the breech emerges the

accoucheur should restrain the desire to aid by traction, but should encourage the woman to bear down strongly. The foot, if it is down, or the breech is to be wrapped in a warm towel as it comes out. Nothing more is done, the operator sitting by with sterile hands. By means of the head stethoscope he listens to the heart-tones almost continuously, and any weakening or irregularity is the signal for rapid delivery. If the foot is out, the baby's pulse may be felt in the anterior tibial artery. Anesthesia is not used unless the patient is very unruly, because her efforts are needed safely to expel the infant. In primiparæ with rigid pelvic floor, or with a big baby, it is my own practice to perform a deep unilateral episiotomy even before the head is to be born. I prefer it to a perineal tear for reasons that have been mentioned. It saves delay in the delivery of the shoulders and the head, and surely has saved many babies' lives, as well as prevented complete laceration of the perineum.

When the navel appears, the rest of the birth must be rapidly, but not precipitately, completed. The woman is told to bear down with all her power. If she is anesthetized or cannot, the assistant, spreading his hands evenly over the fundus, exerts pressure in the axis of the inlet. This strengthens the uterine and abdominal action, and keeps the arms against the chest, preventing their ascent alongside the head, which would much complicate the delivery. If both fail, *manual aid* is rendered. Manual aid means the delivery of the shoulders and head, after nature has accomplished the expulsion to the navel. It must be very sharply distinguished from "breech extraction," which means bringing down the breech in some way and delivery of the whole child from within the birth-canal. (For the details of these maneuvers see Chapter LXXI.) Pituitrin may be given when the breech is visible and ready for delivery, but the fetal heart-tones must be continually studied. Should the natural powers be successful, the accoucheur receives the child as it emerges, and when the mouth is visible in the vulva, he sponges the mucus from it and restrains the head from making a too rapid exit through the pelvic floor. After delivery of the child the accoucheur should be prepared to treat postpartum hemorrhage and all kinds of lacerations.

### TRANSVERSE PRESENTATIONS

Another error of polarity of the fetus is transverse presentation. Here the long axis of the child crosses the long axis of the mother. It is rare that they cross at a right angle: almost always the fetal cylinder is oblique to the mother's spine. Usually the head is the lower pole, but in some cases the breech is nearer the inlet. Often early in labor the head is found deviated from the inlet and lying in one iliac fossa. The breech may be found similarly placed. These are called "oblique presentations," or "deviated head," or "deviated breech" presentations, and represent a stage of the transition from longitudinal to a transverse presentation. By external manipulation and proper posture of the woman the abnormal mechanism may be corrected.

Since the shoulder is the part that usually enters the pelvis first, most authors call the cases under consideration "shoulder presentations," but the back, the side, the belly, or the four extremities may present. True, all the last four are exceedingly rare.

**Etiology.**—Shoulder presentations occur about once in 200 cases, in multiparæ oftener than in primiparæ, and in premature labor oftener than at term.

In general, anything that will prevent the engagement of the head in the pelvis, also any condition conferring an extraordinary degree of mobility on the fetus, will cause transverse presentation. The causes may be primary, and lie in some malformation of the maternal parts or of the fetus, or secondary, being produced by some act or accident during labor. The most important are:

1. Contracted pelvis. Transverse presentations occur twice as often in con-

tracted pelvis as in normal pelvis. So constant is this that when called to a case of transverse presentation, the first thought is of some obstruction.

2. Anything in the pelvis preventing the engagement; for example, ovarian tumor, fibroid, the placenta, full bladder, or rectum. It sometimes happens that after emptying a full bladder the fetus turns of itself into a normal position.

3. Twins displacing each other.

4. Multiparity, hydramnion, premature labor. Here the child is free to move, and the factors making for a longitudinal presentation are absent.

5. Uterus bicornis, uterus arcuatus, partly septate uterus. A cause of repeated shoulder presentations.

6. Anomalies of the fetus, for example, double monsters.

Of the secondary causes, accident plays the stronger rôle. The fetus happens to be in an unfavorable position when the bag of waters ruptures; the shoulder is forced into the pelvis, and a transverse presentation results. The dislocation

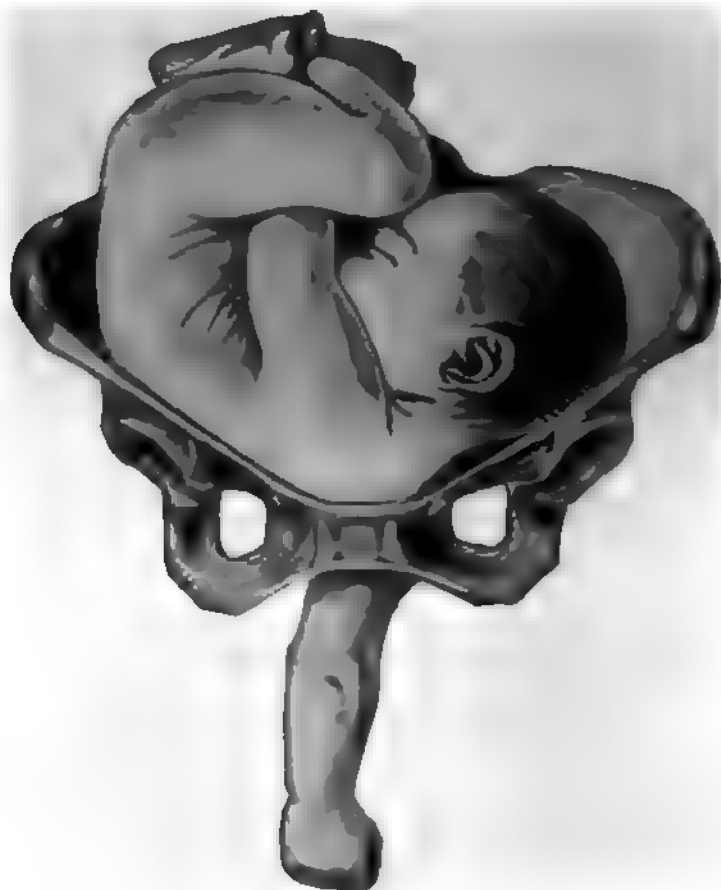


FIG. 545.—SHOULDER PRESENTATION. SC L.A.

of a second twin by the first is also to be reckoned here, and dislocation of the child by an overfilled or badly placed colpeurynter also.

Often several of these factors will combine to cause the malpresentation. In some cases the fetus seems to keep its embryonal position in utero, or the uterus is not tense enough to adapt the fetal ovoid to itself.

**Mechanism and Clinical Course.**—Although the back or the belly may lie across the inlet, the shoulder is the part which most often enters the pelvis first, so that usually we speak of shoulder presentation. On the shoulder these landmarks

are to be distinguished, and they are useful for diagnosis—the scapula, the acromion process, the axilla, and the clavicle. The scapula is selected as the point of direction.

Four positions of the child in utero are observed (Figs. 545 and 546):

Scapulolæva anterior (Sc.L.A.): Head to left, back anterior.

Scapulodextra anterior (Sc.D.A.): Head to right, back anterior.

These are more common, are called back anterior positions, and are easier to deal with.

Scapulodextra posterior (Sc.D.P.): Head to right, back posterior.

Scapulolæva posterior (Sc.L.P.): Head to left, back posterior.

These are rarer, are called back posterior positions, and are much more difficult to deal with. The relations of the back and of the head to the inlet are most important in the study of the mechanism of labor.



FIG. 546.—SHOULDER PRESENTATION. Sc.D.P.

*Attitude.*—Early in labor we find the usual posture of flexion common to O.L.A., the chin on the sternum, arms crossed over the chest, legs crossed over the belly, but later many changes are observed. Commonest is the prolapse of the lower arm, rarely the two, and still more rarely the upper one alone. Prolapse of the cord is not infrequent. When the uterus has worked on the fetal ovoid for any length of time, the latter is compressed from side to side, the head nears the breech, and the ovoid is made more globular. Occasionally the fetal body is twisted on

its long axis, so that, while the shoulder lies deep in the pelvis, the belly, instead of looking to the sacrum, looks directly upward, and the legs also are turned forward. The neck may also be twisted; in one of my cases the child's head was deflected, resembling the attitude of face presentation. Ahlfeld noticed this in a case of breech presentation.

*Course.*—Shoulder presentations are always pathologic. True, they sometimes terminate spontaneously, but with rare exceptions the children all die, and often the mother, too, so that they are cases of dystocia and demand the aid of art. Early in pregnancy transverse presentation is the rule. Even in the last month, in multiparæ, it is occasionally found, but rectifies itself before labor begins, the process, of which the accoucheur usually has no knowledge, being called *spontaneous rectification*. This means that the contractions of pregnancy have changed the polarity of the fetal ovoid, and the process may be aided by proper position of the mother. If it does not take place during pregnancy, a longitudinal presentation may be brought about spontaneously during the first stage of labor, or even at the beginning of the second stage (very rarely). This is called "*spontaneous version*."



FIG. 547.—LABOR IN CONFLICTU CORPORE. RORDERER'S METHOD (Zangemeister).

is not at all a constant occurrence, and in practice is *never relied on*. Both of these processes are more likely where the fetus is freely movable, as in polyhydramnion, and where the presenting part cannot easily enter the inlet, as in contracted pelvis. As a rule, when a change of presentation is brought about, the head comes down, but sometimes the breech may come to lie over the inlet.

In order to study the mechanism of transverse presentation a case will be assumed where no aid is rendered. The pains are likely to be slow and weak, since no hard part presses on the cervix, but the bag of waters often ruptures early, because the membranes are exposed to the full force of the uterine contraction. The lower uterine segment is not cut off from the general cavity of the uterus, so after the rupture of the bag of waters all the liquor amnii escapes, since there is nothing to hinder. This is a bad accident, especially if the cervix be undilated.

When the uterus has no more liquor amnii, the walls apply themselves to the fetus very closely. Two conditions may now be observed: first, there may be no pains at all, the uterus simply lying apposed to the fetus in a condition which was

called by Kilian "passive contraction." The walls are distensible; the hand can be easily introduced, and even version performed. This condition carries no danger to the fetus or the mother, may last a few hours or a few days, but generally passes over into the other state, either spontaneously or as the result of brusque manipulations. This first condition has nothing to do with the so-called tetanus uteri, to be described presently.

Sooner or later, usually the result of improper treatment, the pains begin, and very soon acquire a dangerous violence. They force the shoulder into the pelvis,



FIG. 548.—SPONTANEOUS EVOLUTION. DOUGLAS' METHOD. CHIARA'S FROZEN SECTION.

the fetus is folded together, the breech nears the head, the ovoid becoming more globular. If the fetus is small or macerated and the pelvis large enough, the uterus, aided by powerful efforts of the mother, may succeed in expelling it. This is called "spontaneous evolution," and is the last, least likely, and most dangerous method nature has of overcoming the malpresentation. Spontaneous evolution pursues three methods, named respectively, after the men who first accurately described them, Roederer's, Douglas', and Denman's. According to the first, which usually occurs without prolapse of the arm, the child is folded like the letter V, the shoulder and back advancing, the head pressed deep into the chest and abdomen (Fig. 547).

In Douglas' method, which oftener occurs in back anterior positions with prolapse of the arm, the fetal mass, under the influence of strong pains, becomes pointed, the head is arrested above the inlet and rotates to the pubis, the neck is applied to the brim, and very much lengthened. Now the chest, abdomen, and breech roll down alongside the shoulder, the legs drop out, then the other arm, and finally the head appears (Fig. 548). In the rarest of all three mechanisms, Denman's, which is usually taken by back posterior positions, the head rotates behind, and, as the breech descends, the shoulder ascends in the pelvis, a sort of version taking place in the pelvic cavity, the breech finally coming down and out (Fig. 549). All three mechanisms occur at the end of the second stage; all three require exceptionally favorable conditions—that is, large pelvis, small, soft, molding fetus, strong pains, and great integrity of uterine muscle, and in none of the three will a full-

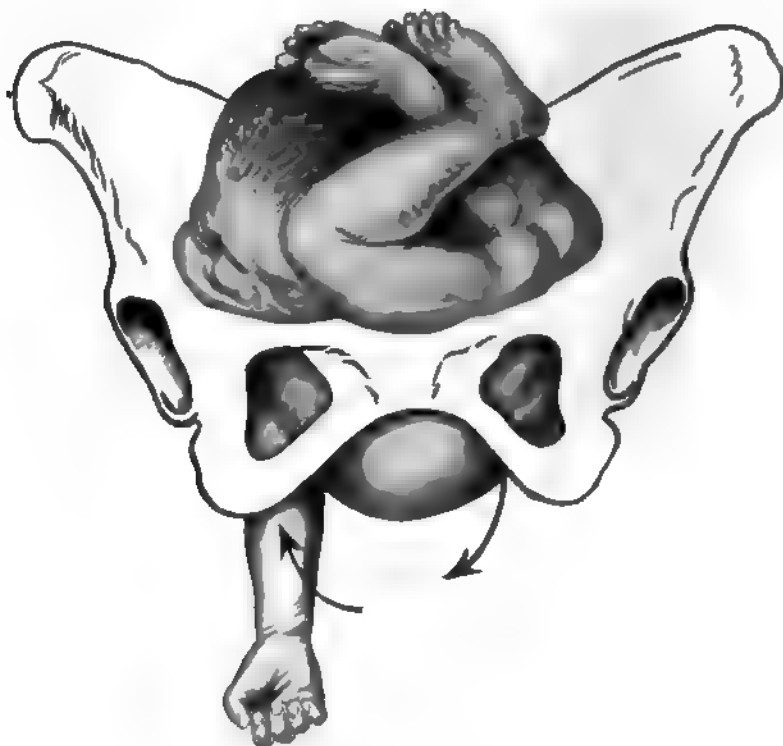


FIG. 549.—LATE SPONTANEOUS VERSION (DENMAN'S METHOD)

term child be delivered alive. Zangemeister reports the heaviest child delivered alive—weight, 2700 gm. Usually the fetuses are macerated or very small. Death is due to compression of the vital organs in the chest and head, interruption of the placental circulation by the almost constant uterine contractions or by dislocation of the placenta in the retracted fundus uteri. Since the child is almost invariably lost and the mother exposed to risks of imminent death during these processes, they are never to be relied on in practice.

Daily experience shows that nature is generally powerless safely to accomplish delivery in full-term cases, and labor is arrested with the child forced together in a compact mass, solidly blocking the pelvis. If the arm hangs out, it swells up, sometimes to the size of a man's wrist, shows blisters or even peeling skin, the child dies, and the vulva becomes edematous, bluish black, and even gangrenous.

The pains become irregular and tumultuous, the distinction between pain and



pause is not marked, and the uterus is in a state of constant contraction. The patient becomes anxious, and complains of continual pain and great tenderness over the lower part of the uterus. Pulse and temperature begin to rise. The uterus draws up over the child; the muscle becomes thick above the contraction-ring; the lower uterine segment is thinned out until it is as thin as a blotter, and here the uterus is likely to rupture (Fig. 550).

This condition is called a "*neglected transverse presentation*," and the uterus is in a state of *threatened rupture*. Where the fundus, thick and contracting,



FIG. 550.—NEGLECTED SHOULDER PRESENTATION.

Uterus on point of rupturing. Above is shown the thick, retracted uterine wall. Below the thinned, lower uterine segment, the white lines indicating the direction of greatest thinning.

passes over into the lower uterine segment and the thinned and dilated cervix, a groove or depression can be seen and felt on the abdomen, running from side to side about the level of the navel. This is the ominous retraction-ring, sometimes called contraction-ring (Fig. 697). Above this groove the parts can be poorly felt; below this groove the fetus is easily felt. Unless aid is given, the uterus ruptures and the mother dies of shock, hemorrhage, or peritonitis. The uterus may rupture during an attempt at version or from the action of pituitrin. Death of the child occurs from the interruption of the placental circulation and from compression before rupture. If not, it dies after the rupture, and may be in part or in toto

extruded through the rent into the abdominal cavity. Or the woman may die of shock and exhaustion before the rupture takes place.

If the uterus should not rupture soon,—and the tendency varies with different women (in primiparæ there is not so much tendency as in multiparæ),—the pain grows weaker and irregular, the cavity of the uterus becomes infected—from the vagina, from the air, from the exposed arm, or from the examining fingers; the fetus and the little liquor amnii left begin to decompose; gas is developed in the uterus and distends it. The condition is called *tympania uteri* or *physometra*. General infection is soon apparent, temperature and pulse mounting rapidly, the features change, a subicteric hue develops, and the poor woman dies in septic collapse. If successfully delivered, the sepsis may continue, but recovery is unlikely when much damage has been done to the structure of the parturient canal.

Another condition that occurs, as well with cephalic as with transverse presentation, is called *tetanus uteri*. It is due to too early, brusque, and unnecessary manipulations on the uterus or cervix, and especially to the administration of ergot. The uterus is in one continual spasm. Occasionally a pain will increase the spasm. One finds the uterus hard all over, very tender, and the woman in continual pain; the cervix is red, dry, and hot; the vagina also is dry and hot. Labor is at a standstill, since in this condition the cervix will not dilate, and it is generally impossible to turn the baby so as to extract it. There is no danger of spontaneous rupture, but the baby dies, due to the interruption of the placental circulation, and unless something is done the mother dies of sepsis.

Fortunately in this country, and also in Europe, cases of “neglected transverse presentation” are becoming rare. The evil results of neglect must emphasize the importance of early diagnosis and consistent treatment.

**Diagnosis.**—During pregnancy abdominal palpation gives the best results, while vaginally nothing but the empty pelvis is felt. During labor the conditions are reversed because the contracting uterus covers up the fetal parts.

**Abdominally.**—(1) No longitudinal ovoid, but one more or less transverse, and, in contradistinction to uterus arcuatus, the broad portion is just above the inlet, not above the navel, as with arcuate uterus. (2) Over the inlet, nothing—the space is empty and the finger-tips may come together over the pelvis. (3) In the fundus likewise nothing; at most, some small parts or a deep furrow. (4) The back is in neither flank, and the hand must search elsewhere. Three of the four cardinal principles of the diagnosis of presentation being negative, the diagnosis must rest on the first, plus other, special findings. In scapulolæva anterior the head will be found on the left side, low in the flank, and it is recognized by its being large, hard, rounding, sometimes with ballottement. The breech is high up to the right behind, the small parts in the fundus to the right of the median line, the heart-tones loudest a little to the left and below the navel. It is easy to outline the dorsal plane in front. In Sc.D.P. the head is deep in the right flank, the breech under the spleen, no back can be outlined, but, instead, the region of the navel seems filled with small parts, and the heart-tones are to the right of the navel, about on a level with it.

**Rectally,** little can be felt unless the shoulder is forced down into the pelvis or the arm has prolapsed. It is better to make a vaginal examination.

**Vaginally.**—An empty vaginal vault immediately awakens suspicion of something abnormal. Sometimes the bag of waters hangs down like a stocking, filling the pelvis, and the attempt to feel something through it may rupture the membranes, which would be very unfortunate. The cervix hangs down like a cuff, and collapses in the interval between pains. After labor has progressed a short while the shoulder is more accessible, and, especially if the membranes are ruptured, all the landmarks may be discovered. These are the acromion process, the scapula, the clavicle, and the axilla. The direction in which the axilla is closed, that is, its apex, points to the fetal head. By noting whether the hard edge of the scapula looks to the pubis

the sacrum we are enabled to say that the back lies to the front or to the rear. In S.L.A. the apex of the axilla points to the left, the edge of the scapula lies to the front, and the costal gridiron to the rear. Prolapse of the arm or elbow will aid diagnosis. When the hand is down, the direction of the thumb and the bend of the elbow will be toward the child's abdomen. By trying to shake hands with the child it is possible to decide which hand is prolapsed. In Sc.L.A. the right arm—lower one—almost always falls down; therefore if you find the head on the left and the right arm down, it is safe to diagnose this position. While much can be learned from the position of the arm in living fetuses, preserving the tonus of muscles, it is safest to follow up the member to the thorax and try to discover the axilla, the ribs, the pipe-stem-like clavicle, and the scapula,—even the rosary-spinal column,—which gives absolute information. In scapulodextra posterior the axilla points to the right behind (Fig. 552), the costal gridiron to the front, the head also to the pubis, the edge of the scapula is behind, and the arm, if down, is the right one. Since in very rare instances the upper arm prolapses, one must be careful in making diagnoses on the direction of the hand.

After labor has been in progress for a long time the parts become so swollen that diagnosis is difficult, and if the back or belly is forced down into the pelvis, difficulties encountered may be very great and should warn to unusual care,

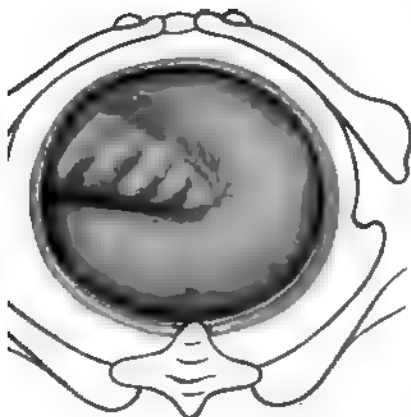


FIG. 551.—TOUCH PICTURE. Sc.L.A. Apex of axilla points to left. Note costal gridiron.

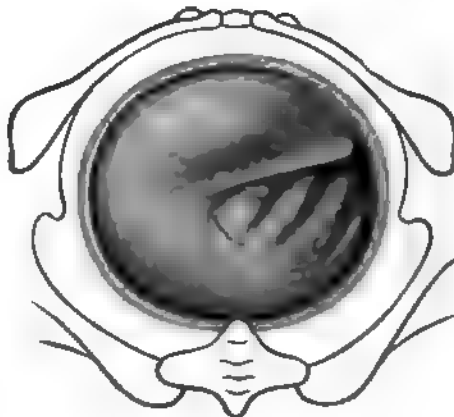


FIG. 552.—TOUCH PICTURE. Sc.D.P. Apex of axilla points to right.

use even very skilful accoucheurs have made costly errors. In the differential diagnosis breech, face, and vertex presentations, with prolapse of the arm, have to be considered, and confusion will be avoided by carefully searching for the landmarks peculiar to each.

Of great importance is the diagnosis of the state of the uterus as regards the presence of rupture and the presence of tetanus, and no examination is complete without thorough study of the size of the fetus and of the cavity of the pelvis. In neglected shoulder presentations the accoucheur must discover if nature intends to terminate the case unassisted, and if so, which of the three modes will be chosen. If these points are properly evaluated, the accoucheur will be able to lay out that line of procedure which will most likely lead to a happy ending of the case.

**Prognosis.**—Transverse presentation being always dystocic and requiring the intervention of art, the prognosis depends on the ease and safety with which such intervention may be made. If an early diagnosis is made, the outlook for both mother and babe is excellent. In neglected cases the existence of infection, trauma—from ill-directed interference, and even of rupture of the uterus, indicate a grave situation, and to all these must be added the dangers of the inevitable laceration. In a recent article Schultze shows that in Germany alone fully 400

change of polarity of the body, and, further, the chances of the child are not much improved by the operation, since extraction may not be done at once, and during the long wait for complete dilatation the child usually dies.

It is better to replace the cord above the head and put a metreurynter in the cervix, to prevent its falling down again. H. M. Stowe advised to fill the uterus with salt solution after replacing the cord, and invented a metreurynter for this purpose. Replacement of the cord may be accomplished with a catheter and stilet, as shown in Fig. 559, *g* and *h*, the catheter being left in place until complete dilatation has been obtained, or the two fingers may be employed to push the cord up. All these manœuvres are carried out with the woman in the knee-chest posture, in order to get the benefit of gravity, and, before the hand is withdrawn, a metreurynter is inserted in the lower uterine segment and filled with 12 ounces of weak antiseptic solution, or the cervix is packed with gauze—this precaution to hinder the cord from falling out again and to keep the head away from the inlet. After the cervix is thus thoroughly plugged, the woman may be placed on her back or side. Neither of these methods is uniformly successful. The repositor may kink or injure the cord or wound the uterus, and the fingers may not be able to push the loops above the globe of the head, and in both instances the cord is likely to pro-



FIG. 558.—KNEE-CHEST POSITION.

lapse again as soon as the woman is laid on the back or when the colpeurynter comes out. Then, too, the cord may not be relieved of compression by the operation, and even the bag may press on it. In one case where the cord could not be replaced I pulled the arm down alongside the head and tucked the cord beside it, thus protecting it from injury. A thick rectal bougie might be used for this purpose.

(b) If the cervix will admit the hand, there are two methods to choose—version and reposition of the cord. Equally good results are obtained from both operations; the choice, therefore, will depend on individual skill and preference, plus the conditions presented by each case. Version will be selected when—(1) Other indications for version are present; (2) when a contracted pelvis of minor degree coexists; (3) in face, brow, or other abnormal presentation; (4) when an indication for delivery on the part of the mother or child arises or is to be anticipated; (5) when reposition has failed or the cord fallen down again.

It is always desirable to secure complete dilatation before turning, because it may be necessary to follow the version with the accessory operation of extraction.

Reposition is practised as follows: If the woman will permit the operation without an anesthetic, the knee-chest posture is employed; if not, the exaggerated Trendelenburg is used. Passing the whole hand into the vagina, the cord is

Difficulties are met; if it is not, manual dilatation, Dührssen's incisions, even vaginal cesarean section, may be employed, and then forceps applied. Which method will be selected depends on the condition of the cervix as regards effacement and dilatation and the accomplishments of the accoucheur.

If, when called to the case, the cord is found pulsating feebly or not at all, the accoucheur's first duty is to determine, so far as possible, the actual condition of the child and its chances for ultimate recovery even if delivered alive. It is no feat to be proud of to deliver a child at the expense of extensive maternal injuries when the child dies after a few minutes or hours from late asphyxia or cerebral hemorrhage. In a prolapse of the cord finds the accoucheur unprepared for its proper treatment,

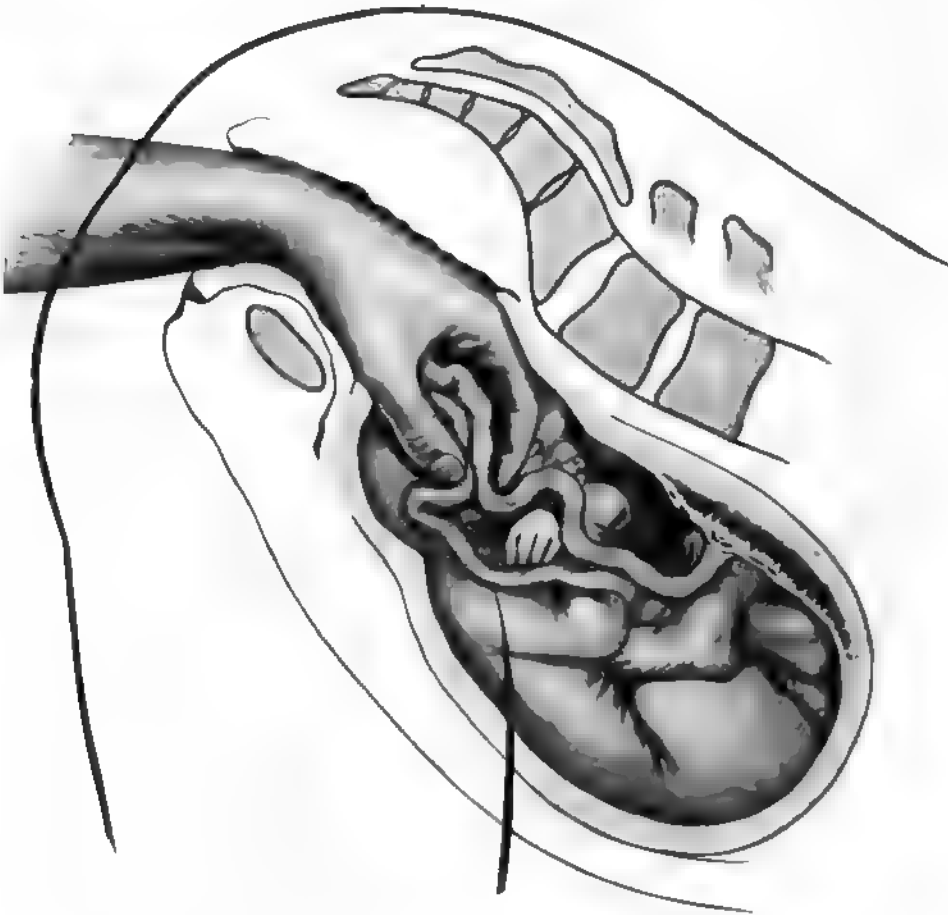


FIG. 560.—REPLACEMENT OF PROLAPSED CORD WITH WHOLE HAND. PATIENT IN KNEE-CHEST POSTURE.

The head may be held back and the cord protected by the hand inside until assistance can be procured.

When the infant is dead, the case is to be left to nature, but if an indication for delivery on the part of the mother arises, craniotomy is the operation of choice. In a primipara craniotomy on the dead child should be recommended to save the perineal floor from the overdistention. Forceps and version on a dead child are contraindicated. Of course, if there is doubt of the life of the child, it should have the benefit of the doubt. What to do when the cord is pulsating only feebly and there is reason to believe the death of the child is not far distant is not easy to decide. If the child can be quickly brought to light without the danger of serious maternal

ane rupture, as a rule, the head enters the pelvis, the arms being held back, sometimes the arm prevents the engagement of the head. Here the extremity is replaced, using the half or the whole hand, under anesthesia, if necessary, fails, or if the arm falls down again, version is performed. Version is also then, in addition to the arm, the cord is down or the placenta is low in the or any other indication for changing the polarity of the fetus exists.

After the head has engaged with the arm nothing is done because there is usually enough room in the pelvis for the two. Since labor is longer and abnormal rotation commoner, forceps are more often needed. In applying the forceps to see that the blades do not grasp the arm is necessary.

**Arms in the Nape of the Neck.**—Fig. 561 shows a rare anomaly of attitude. It

is described first by Simpson. The author has met with only one instance of it.

In 25 cases have been reported, mostly English. In all the engagement of the head and the arms, crossed the brim, effectually preventing the attempted forceps delivery, and the patient lying under the impression of a distended chest as the cause of the obstruction, it was only after the use of the left hand, under deep anesthesia, was passed up, that the real reason was ascertained. With considerable difficulty the arms were brought into proper position and the instrumental delivery was easily completed.

Unless such repositioning of the arms is attempted, the case will be hopeless.

Version was successful in Simpson's, Gray's, and Lambert's cases. Every thing may have to be done; then, when sufficient room is procured along with a crushed head, the arms may be reached and either pushed out of the way or pulled down.

**Lapse of the foot alongside the head** is very rare, and only six such cases are in the author's experience. Version in each instance was easy, though others say it is difficult under the circumstances. Since the fetal cylinder is rigid, slow advance and delayed rotation are usual, and, therefore, forceps are needed. If the foot prevents engagement of the head, it may be pushed

and the head led into the pelvis by combined manipulation; if this does not succeed, version is the treatment. If the foot and head have engaged in the pelvis, expectancy and forceps, if needed, are recommended.



FIG. 561.—ARMS IN NAPE OF NECK.

Mrs. L. Primipara. Eclampsia. Heart disease. Readjusted arms. Forceps.

#### LITERATURE

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*McPherson*: *Bul. New York Lying-in Hosp.*, 1917.—*Schulze*: *Monatsschr. f. Geb. u. Gyn.*, August, 1917, No. 2, p. 137.—*Simpson*: *Obstetric Memoirs*.

urse.—Pregnancy may be interrupted because of a non-viable hydrocephalic

Labor is usually a little premature, and is often notable because of weak  
out, owing to overdistention and  
g of the lower uterine segment  
e mechanical obstruction to  
rupture of the uterus is a fre-  
complication. For example, in  
ard's 74 cases 14 had uterine  
a. Breech presentation is much  
equent than usual, and the soft  
omes through easier than when  
the way. A small hydroceph-  
ay be delivered easily, or with  
ght help from art; a larger one  
gives trouble, but, curiously, a  
rge head not strongly distended  
th soft bones may mold its way  
h the pelvis. A dead and macer-  
tus may also pass easily, espe-  
f the pains are good. Pressure  
s and fistulas, from prolonged  
nd operative errors, are some-  
observed. The head remains



FIG. 562.—HYDROCEPHALUS (Museum of Northwestern University Medical School).



FIG. 563.—HYDROCEPHALUS, MOLDING ITS WAY INTO PELVIS.

he diagnosis. If the bones of the cranium are thin, the crackling craniotabes will be felt, and by bimanual palpation, the use of which is too much neglected in obstetric diagnosis, the immense size of the head is easily distinguishable. In the differential diagnosis a small hydrocephalus must be separated from a large but normal head. A thin-walled hydrocephalus may simulate the bag of waters or the urinary bladder. Macerated and edematous fetal scalp, cystic tumors on the head, encephaloceles, and tough membranes have been wrongly diagnosed. A hydrocephalic child presenting by the breech is usually not discovered until the head is arrested at the inlet. Occasionally a spina bifida or other deformity will excite suspicion of an associated hydrocephalus.

**Treatment.**—Since the child almost invariably dies and is doomed to early death even if delivered alive, all effort is directed to save the mother. Perforation of the head with a trocar is the operation recommended by almost all writers. A long scissors will do if a trocar is not at hand, and the hole is made in the most accessible part of the head. In breech cases a spot beside the ear is usually the best, but the operation has been performed through the mouth and the spinal canal. Where the possibility exists that the child may survive the delivery, the spot chosen for the puncture should be away from the cerebral sinuses.

After the fluid is evacuated the collapsed cranium offers little resistance to the soft parts and is usually quickly delivered. Should an indication for rapid delivery arise in a head case, traction may be exerted on the collapsed sac, and if this tears, as is usual, the cranioclast may be applied to the base of the skull and the cervical spinal column. Version may also be done, but a skilful operator will seldom need to expose the uterus to the additional risk of rupture thus involved.

#### DISTENTION OF THE ABDOMEN

This may result from ascites, enlarged liver, neoplasms and cysts of the liver, congenital cystic kidneys, dilated bladder or ureters, and a few other isolated conditions. Ascites accompanies most of those mentioned. Syphilis plays an important rôle in the causation of ascites, fetal peritonitis, and liver diseases. The diagnosis of excessive abdominal distention of the fetus is seldom made until delay in the exit of the child is manifest. Great abdominal distention of the mother or polyhydramnion will only direct attention to the possibility of a fetal anomaly. In head cases, after the shoulders are ready to escape from the vulva, progress is arrested, and in spite of strong traction delivery may not be effected. Examination with the whole hand will clear the diagnosis. Fig. 565 shows a case of labor arrested by congenital cystic kidneys. Since the breech did not advance, the hand was inserted and the large belly easily circumscribed with the fingers.

**Treatment.**—In head presentation, after the head is born and the distended trunk will not come, several ribs and the sternum are to be excised with Siebold's scissors, the lungs and heart removed, the diaphragm punctured, and the abdominal contents thus evacuated. When the breech presents, simple puncture of the belly suffices in ascites, but if there is a solid tumor also, it is removed by morcellation.

#### TOUGH MEMBRANES

The membranes are sometimes a source of obstruction to labor, and a slightly increased resistance here may be the cause of great delay. They may be either adherent over the internal os and lower uterine segment, thus preventing the dilatation of same, or they may be so tough that they do not rupture when the cervix is dilated. In either case labor is retarded: in the one at the beginning, in the other at the end, of the first stage. The second is easily recognized—delay after complete dilatation.



Lack of progress in the first stage of labor, due to adherent membranes, may be suspected when the os dilates very slowly in spite of good contractions, the head being well down in the pelvis, the completely effaced cervix fitting it closely like a cap, and the membranes stretched tightly over the scalp, with no, or hardly any, forewaters. The adhesions may be felt. Labor may be delayed one or two days by such a condition.

**Treatment.**—In the first stage it is advisable to push up the head a little, to loosen the membranes all around the margin of the internal os to the extent of one inch, and allow a little liquor amnii to come down, to make a good hydrostatic dilator. After several hours, if delay is still manifest, it is justifiable to rupture



FIG. 363.—CONGENITAL CYSTIC KIDNEYS WITH ASCITES OBSTRUCTING LABOR (author's case). After the ascites was let off the large kidneys still gave difficulty. Patient's sister had a similar anomaly, but not so marked.

the membranes. Indispensable conditions for this little operation are: Occipital presentation and engagement of the head, effacement of the cervix, normal pelvis, and soft parts.

When tough membranes do not rupture after complete dilatation of the cervix but delay is manifest for one or two hours, it is justifiable to rupture them. Conditions are: the pelvis may not be contracted; the child not too large; the head must be well fixed on the inlet; the presentation and position must be normal. Special additional indications are required in those cases where these conditions are not fulfilled.

After fixing the head in the inlet from without so as to prevent the prolapse of the cord and extremities, the membranes are pierced with a pointed instrument

issors, for example,—and the finger immediately placed against the opening. This is to permit only the slow escape of the liquor amnii, which guarantees the safety of the cord. As the liquid slowly trickles away, the assistant from the outside forces the head into the pelvis. Should the waters start to come with a rush, the operator holds the labia together, thus closing the vulva. Some accoucheurs perform the operation with the patient on the side. When performed for the proper indication and under filled conditions, labor usually terminates very quickly.

### DRY LABOR

At any time during pregnancy the membranes may rupture. Pains almost always come on within a few hours or days, and the uterus empties itself.

If the accident occurs in the early months the membranes collapse, the fetus develops outside of them, and pregnancy may continue for as long as one hundred and twenty days (Meyer-Rügge). This condition has already been considered (see p. 490). It is called *graviditas exochorialis*, and the main symptom is *hydrorrhea gravidarum*. Breech presentation is almost the rule in such cases, the child is usually deformed, is seldom viable, and the placenta shows a "margo" in nearly all cases, the shrunken membranes hanging around the insertion of the cord. Abnormal third stage has nearly always been noted.

Rupture of the membranes in the later months of pregnancy, with few exceptions, is followed by labor within three or four days. I observed one case where labor was delayed ten days. Ahlfeld observed one of thirty-three days. It sometimes requires other agencies to get the uterus into action after the membranes are open.

The treatment of premature rupture of the bag of waters is expectancy, rest in bed, and sedatives. Coitus, douches, and examinations are forbidden in order to preserve the amniotic cavity from infection. In the later months of pregnancy, owing to the patulousness of the cervix, rupture of the membranes is often succeeded by fever, and, therefore, I do not usually wait for pains to supervene. If the uterus does not assume action within six or seven days I usually start it by inserting a *colpeurynter*.

When the membranes burst shortly before or early in labor, it is a very unwelcome accident. The case is then called a "dry labor." Special disadvantages attach to it in cases of shoulder, breech, face presentation, occipitoposterior positions, and in contracted pelves. The gentle cervical dilator is lost (see p. 215) and the cervix may suffer injury; the hard head pressing on the cervix causes more pain; the increased friction of the child against the dry uterus delays progress. The uterine wall applies itself to the irregularities of the fetus which irritate the muscle to irregular contractions, constriction rings being prone to form. All these factors tend to prolong the labor, and make anomalous and inefficient pains. Rotation is often arrested, the cervix remaining undilated, swollen, edematous, the patient becoming discouraged and exhausted, or getting into a highly excited state. The child suffers from injurious compression, since the brain is exposed for hours to the full power of the forces of labor. Since frequent internal examinations are required, and very often operative interference, the dangers of infection are added to those of injury. The amniotic cavity becomes infected, and Warnekros has shown that temporary bacteremia occurs. Slemons found bacteria under the epithelium of the amnion and also showed that the child may die during or shortly after labor from infection thus acquired—a contention the author has held for many years.

The mortality and morbidity of both mothers and babes are increased in dry labor. In *primiparæ* premature rupture of the membranes is more serious than in *multiparæ*, indeed, in an aged *primipara* at term, with a hard resistant cervix and *perineum*, with dry labor, one might well consider cesarean section.

Syphilis causes a very serious form of cervical rigidity, and is, fortunately, rare; the whole cervix is changed into a tough, fibrous, undilatable tube. Cesarean section and craniotomy have been found necessary. Scars from ulceration may close up the cervix so that the finest probe may not discover the passage, and if, as sometimes happens, the cervix has sloughed off, the vault of the vagina may be one arched, smooth scar, in which the opening into the uterus cannot be found. One of my Porro cesareans was for this condition, complicated by a rectovaginal fistula—all the result of a previous puerperal septic process. Obstruction of the cervix is one of the causes of "missed labor."

Labor, in cases of cervical disease, shows delay in the first stage, and a great



FIG. 566.—CONGLUTINATIO ORIFICII EXTERNI.

deal depends on the site and extent of the stricture. If it is in the supravaginal portion of the cervix, the worst forms of dystocia arise; if in the vaginal portion, the case is easily handled, and there are intermediate forms. Under the action of the pains the cervix dilates up to the point of obstruction. If the pains are strong, the uterus healthy, and the stricture not too rigid, nature finally succeeds in procuring a passage for the child. If not, labor stops, the child dies, the cervix may tear, the child being born through the rent, or the uterus may rupture and the child escape into the abdominal cavity, or (rarest) the cervix may tear off circularly in part or in toto. At the Chicago Lying-In Hospital a colpeurynter, put in the uterus to facilitate delivery through a scarred, indurated cervix, was expelled, bringing the cervix torn off circularly with it. Usually the posterior cervix is

in, the child escaping through the rent, the ring-like piece hanging alongside it.vere dystocia due to pathologic cervixes is rare. Slight induration, which strengthens labor but allows spontaneous termination, is fairly common. A large number of children are lost through delay caused by rigidity of the cervix (Seitz).

**Diagnosis.**—Not every hard cervix is caused by anatomic disease. As was said, normal uterine action can produce secondary cervical rigidity. The diagnosis must comprise the cause, the nature, the location, and the extent of the stricture, and the relation of surrounding organs; for example, as in one case where the cervix *toto* was missing, the bladder lay close to the rectum, and a rectovaginal fistula existed. "Relative rigidity" of the cervix exists when an indication for delivery exists, but the cervix is closed, though normal.

**Treatment.**—Cesarean section as a primary operation is to be performed where careful examination has proved that obstruction exists, unamenable to the ordinary methods. If the stenosis of the cervix is very marked, the Porro operation could be done, because the passage will be too small to permit the escape of the placenta. In cases where the stricture does not appear to offer an insuperable obstacle to labor, the action of strong pains is to be awaited. When it is evident that nature has accomplished as much as she is able, art steps in to aid in overcoming the rigidity. Five methods of dilatation of the cervix are practised: (1) By means of the hands, advocated since the time of Celsus, and perfected by Bonnaire and Morris; (2) the use of rubber balloons; (3) instrumental dilators of the glove-stretcher design, of which Bossi's is the best known; (4) the incisions of Dührssen—sterostomotomy; (5) the vaginal cesarean section of Dührssen.

In mild cases, where the cervix is effaced and the os more or less dilated, the fingers usually are able to stretch the opening sufficiently to permit delivery. Most invariably the cervix tears more or less. If the ring is too tough to be stretched, clean incisions radiating to the fornices may be made. When the cervix is not effaced, these methods are dangerous and inefficient. If an indication for rapid delivery on the part of the mother or child does not exist, a metreurynter can be put into the uterus and the effect of the hydrostatic dilatation tried. Often the cervix will soften sufficiently. If it does not, or if delivery is required, the vaginal cesarean section is the operation of choice. Bossi's dilator is not to be recommended. (See Chapter LXIX.) In cases of annular rupture of the cervix nothing can be done if the amputation is complete except to whip the vaginal edge over the raw surface as much as possible. If incomplete, the detached portion may be sutured in place if the accoucheur considers its nutrition not too much compromised; otherwise it should be removed, always cutting off as little as possible, to avoid stricture of the cervix, and covering the raw surface with the vaginal skin that can be gotten into place.

**Stenosis of the vagina** is an occasional cause of dystocia.

**Etiology.**—Congenital deformities, duplicity (already considered), atresia (usually causes sterility), vaginal bridges or septa (the relics of congenital duplicity), tumors in and near the vagina, hematoma of the neighboring cellular tissue, cicatrices from previous ulcerative processes, puerperal sepsis or injury following labor, scarlet fever, diphtheria, measles, variola, syphilis, and gonorrhea. In one of the author's consultations the cervix and vagina sloughed out *toto* after a hard, high-ceps delivery, leaving a narrow, tortuous passage, hardly sufficient for the menstrual discharges. In another, after measles, a portion of the vagina became sacculated and contained pus, and the cavity burst during delivery. (See also Brindeau.) Sometimes, in small women, the vagina is too narrow for safe delivery. In women who have been married a long time without children, and in prostitutes, the vagina may be constricted and tough, so that it will not dilate, but when forced, tears. First primiparæ also are likely to have rigid vaginas, and in cases of frigidity sexu-

alis the author has often found a short, dry, indistensible passage. Finally, the vagina may be relatively too small; that is, it may be normal, but in the presence of some indication for immediate delivery it is unprepared for rapid dilatation.

Labor in cases of vaginal atresia is not delayed until the head reaches the point of obstruction. Congenital septa or bridges are usually pushed aside or torn through by the presenting part; rarely is dissection required. Tumors may be flattened or even extruded before the head, as occurred in one case of large vaginal cyst in the author's practice. Vaginal rigidity is usually overcome by the powers of nature, the vagina softening or dilating, though sometimes splitting longitudinally—the last oftener during operative interference. Even a scar may sometimes soften and dilate under the influence of the pains, but scars often give rise to obstinate dystocia.

**Diagnosis.**—This is easy, the finger meeting a hard ring or narrow passage beyond which the cervix is felt, but care is required to determine how much the contiguous organs are involved. Sometimes the vagina folds up before the oncoming head and a stricture is simulated (Fig. 118). Such a fold is soft and easily pushed open. Even rectally a hard rigid cervix may be recognized, but probably not vaginal anomalies.

**Treatment.**—Cesarean section is performed when the first examination shows an insuperable obstacle to delivery, and if the passage is apparently too small to allow the escape of the lochia, the uterus must be amputated. A cicatricial septum may be split by three or four radial incisions, care being exercised to avoid opening the rectum or bladder. Occasionally a stricture may be dilated with a colpeurynter. A rigid or small vagina may be better prepared for the dilatation it has to undergo by means of the colpeurynter. During operative delivery a narrow, tight vagina must not be allowed to burst: it is better to incise it. Since the tears almost always occur in the lower half, a deep vaginoperineal incision will usually suffice (*vide infra*). A vaginal tumor may be enucleated, or at least enough of it removed to permit extraction of the fetus. A cyst may be enucleated or, if need be, punctured. A hematoma may be punctured, the clot evacuated, and, after delivery, the cavity packed with gauze.

**Rigid Pelvic Floor.**—Two forms of rigidity of the pelvic floor may be distinguished, anatomic and spasmodic. Disease of the muscles or connective tissue may compromise the dilatation of the parts—for example, syphilis, scars from injury or from previous labors, the cicatrices following repair operations, hematoma, and hypertrophy of the muscle. Bicycle-riding hardens the perineum, and old primiparae will often present such a complication in addition to rigid vagina. Spasmodic rigidity may be found in those women subject to vaginismus; it is a spasm of the levator ani muscle, and in one of Benicke's cases necessitated the use of forceps. Sometimes a nervous, apprehensive parturient will contract the outlet of the pelvis and stop labor. Here a narcotic, by relieving the pain, aids delivery.

Labor progresses until the presenting part is on the perineum, and then delay is manifest. If the parturient has a good reserve store of strength, she will be able to overcome the added resistance. If not,—if it has been wasted by premature bearing-down efforts or if the woman has an oversensitized nervous system,—arrest of the head now occurs and exhaustion begins, the life of the fetus also coming into jeopardy.

Seitz (*loc. cit.*) shows the importance of rigid pelvic floor in his statistics from the Munich Maternity, by proving that one-third of the fetal deaths in head presentation are due to delay in labor at this point. Our own experience confirms this and emphasizes the strong necessity to listen to the fetal heart-tones every few minutes toward the end of the second stage. By following this practice a very large number of children will be saved.

**Diagnosis.**—Delay at the end of the second stage demands careful examination.

ne will diagnose a rigid pelvic diaphragm only when it is manifest that the head presses firmly on the pelvic floor but does not advance. To be eliminated as causes of delay are contracted bony outlet (funnel or masculine pelvis), overgrowth of the child, faulty rotation (deep transverse arrest—occipitoposterior), enlargement of the trunk of the fetus, a short cord, and primarily weak pains. The diagnosis of an asphyxia threatening the child forms part of the accoucheur's duties at the same time.

*Treatment.*—When the parturient has shown her inability to overcome the resistant pelvic floor, or when the child begins to show signs of asphyxia, delivery must be accomplished. One should not wait until the mother is exhausted or until her nervous system is tried to the limit; rather one should determine how much nature can accomplish, not how much she can endure. Resistance at the outlet may often be overcome by a deep episiotomy, and this little operation will obviate many applications of the forceps. If the birth does not now occur, forceps are applied and nothing has been lost, because in all probability episiotomy would have been done in any case to avoid deep rupture of the perineum. Tetanic spasm of the levator ani is treated by anesthesia, failing which the forceps are used.

**Stenosis of the Vulva.**—Congenital closure of the vulva is usually complete, and, when an opening exists, it leads to a deformed uterus and tubes, so that conception is almost unknown. As a unicum may be mentioned the case of von Meer, of pregnancy in the uterus connected with the bladder, coitus, and abortion per ethram. Acquired closure of the vulva may result from injury—burning with lime or acids (author's case), inflammation with ulceration in childhood. A pinlike hymen may offer a distinct resistance to the exit of the head. In one of the author's cases, when cut, the hymen was one-fourth inch thick. Hymenal septa may offer a slight barrier to progress, but they usually break, or can be easily ripped in two. Edema of the vulva resulting from prolonged and obstructed labor may sometimes be very great, and the labia may even slough off. This is usually due to concomitant infection. Sometimes the edema seems to aid the dilatation of the vulva; again it seems to predispose to lacerations of the tissues. Hemorrhoids do not delay labor, but they comport the dangers of hemorrhage and hematoma.

*Treatment.*—When it is plain that the vulvar outlet is holding the presenting part back, the resisting ring is either to be stretched with the fingers or incised (episiotomy). A closed hymen is incised radially. In the author's case of stenosis of the vulva due to carbolic acid burn the child was delivered outside the bony pelvis under a tough, glistening scar, which, with the skin, dissected itself off the perineum and thighs to the extent of 6 inches. After a long median incision had released the dead fetus the flaps were readjusted and sewn in place so as to form a new vulva and a shallow vagina.

**Infantile Genitalia.**—Infantilism of the genitalia is not very rare, and often leads to absolute or "one-child" sterility. It is one of the findings of the status hypoplastica. Dysmenorrhea, dyspareunia, frigidity sexualis, nervous weakness, and a syndrome which resembles Basedow's disease are the usual symptoms, and tendency to firm obesity is noticeable. The vulva is small, with little hair; the vagina narrow, short, and hard, with little secretion; the fornices flat, the uterus being either normal in size, but infantile in shape (large cervix with small fundus), or very small and undeveloped. Not seldom it is found bent or curled on itself in sharp, retroposed anteflexion. Bossi called the cervix "tapir nosed." The pelvis is either generally contracted, of infantile type, or it is large, with masculine lines and a funnel outlet. It is very probable that the thyroid gland or the anterior lobe of the hypophysis is concerned in this hypoplasia (Goetsch). Marasmus of steric origin in early life and prematurity are also causative. Should pregnancy sue, abortion in the early months is frequent, and this often ends the reproductive

effort of the individual. Labor is characterized by weak pains and delay in second stage. This comes from both the rigid vagina and perineum and the outlet. Instrumental delivery is often required, and it is usually attended by extensive lacerations. Postpartum hemorrhage is common, and because of the anemia a small loss of blood may be serious or fatal. Because of the vascular hyperplasia accidents of narcosis must be watched for. It is highly important to protect the fetus in these cases, because the first is so often the only pregnancy. The effects, as pointed out by Pfannenstiel, are retroflexio uteri from overstretching the isthmus, and prolapsus from injury and overdistention of the levator ani and subsequent atrophy.

**Labor in Old Primiparæ.**—The best years for women to bear children are from eighteen to twenty-five. With added years the function of childbearing is attended with increasing difficulties, although these are all exaggerated in popular mind. Indeed, I have observed several noteworthy exceptions to what is believed are the usual accompaniments of labor in such cases, for example, a precipitate delivery, the pains lasting one hour, and minimal lacerations in a primipara aged forty-one.

In general it may be said that in older women the pregnancy disorders, by emesis, eclampsia, abortion, and premature labor, are more frequent. Contracted pelves, usually the just minor, the infantile, or the masculine types, are often met. Labor is longer in all three stages. Premature rupture of the membranes, cervical and perineal rigidity are more common; indeed, the soft parts may be so inelastic that they tear in all directions, like old rubber, when stretched. (See p. 6)

Face, breech, and shoulder presentations, occiput posterior positions, and dorsal transverse arrest are more frequent, while the action of the uterus may leave much to be desired. Since the pelvic synchondroses are rigid the nutation of the sacrum is absent and thus delay in delivery occurs. All these retard labor and necessitate frequent recourse to forceps. They increase the danger to mother and child: the one, lacerations and infection; for the other, cerebral injury and death from asphyxia. Postpartum hemorrhage from lacerations and uterine atony have also been noted. The after-effects on the nervous system are more pronounced, so that puerperæ requiring a longer time for recuperation. Nursing is less likely to be adequate and breast troubles are prevented with greater difficulty. Prolapsus uteri is more prone to develop in later years. Primiparity in advanced years has lately become a factor influencing the indications for many operations, often in borderline cases, swinging the decision toward abdominal delivery in preference to vaginal.

**Labor in young primiparæ** shows little variation from the usual. Eclampsia, premature delivery, atonia uteri, and breech presentation are slightly more frequent. Labor is shorter, somewhat easier, and has less hemorrhage. The pelvis is larger than one would expect. General rules for treatment apply. (Specht, literature)

#### DYSTOCIA DUE TO OBSTRUCTION OFFERED BY OTHER PELVIC ORGANS

**Bladder.**—A full bladder (Fig. 567) prevents the engagement of the head, and labor may not proceed until it is emptied. It may cause deflexion attitudes and predispose to prolapse of the cord. In one case it appeared to me to favor a circumflex position, because the back at once came to the front after the viscus was emptied by catheter. It causes weak pains and interferes with bearing down efforts, and thus increases the number of forceps operations. A cystitis may delay the labor, and itself run the danger of severe contusion or bursting. Anterior descent of the bladder full of urine may obstruct the delivery of the placenta or weaken the uterine contractions, in either case causing postpartum hemorrhage or retention of the placenta.



FIG. 567.—FULL BLADDER CAUSING DYSTOCIA.



FIG. 568.—FULL RECTUM AS OBSTRUCTION.



## ANOMALIES OF THE BONY PELVIS

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Fehling, Bayer, Balandin, Freund, Breus, and Kolisko might be mentioned as a few of the many who took part in it. We cannot go into the details of the discussion, but briefly may give the results, which are now quite well established. In general there are two factors which form the adult pelvis, the first and most important being the inherent property of growth of the bones; the second, the mechanical influences exerted on the growing child. That the inherent growth-tendencies of the bones are the determining factors is proved by—(a) The pelvis of the new-born girl already differs slightly from that of the boy; and (b) though subjected to the same mechanical influences, assumes, in its maturation, a much different shape; (c) even when distorted by disease, after the cause is removed, nature tries to correct the deformity for example, in rachitis; (d) when other anomalies of growth are present abnormality of the pelvis often coexists, for example, aplasia of the genitals with infantile pelvis.

Mechanical influences after birth are auxiliary in the production of the developed pelvis. Litzmann (1861) and H. von Meyer emphasized the action of the pressure of the trunk, and considered also the resistance of the pelvic bones and car-

tilages and the dragging force of the muscles and ligaments of the pelvis.

The three bones of the pelvis are put together so that the sacrum does not act like a keystone or wedge. The sacrum is movable, being held in place by the ligaments, aided by the interlocking of the roughnesses of the apposed articular surfaces of the ilia.

In the growing child the line of direction falls through a point somewhat anterior to the sacrum. This causes pressure to be exerted on the first sacral vertebra when the child is erect or sitting. The lower end of the sacrum is prevented from going backward by the strong sacro-sciatic ligaments. A bending of the sacrum, therefore, occurs in



FIG. 570.—PELVIS OF NEW-BORN GIRL (Northwestern University Medical School)

the sagittal diameter, which is most marked at the third sacral vertebra.

A tendency of the sacrum to become concave from side to side, which might result from the same factors, is counteracted by the weight of the body, transmitted through the spinal column to the sacrum (the "body or trunk pressure"), forcing the bodies of the sacral vertebrae downward. In pelves softened by disease this forcing down and forward of the vertebral bodies is very pronounced. Another effect of the trunk pressure is the flattening of the posterior portions of the bodies of the vertebrae.

The *body pressure* also forces the whole sacrum, and, of course, the promontory, more into the pelvis; when the sacrum goes down, it puts the iliosacral ligaments on the stretch, and this gives the posterior iliac spines the tendency to approach each other. This would be attended with a separation of the symphysis were this joint loose (Fig. 571). Let us call this tendency of the innominate bones to separate at the pubis, because of the iliosacral ligaments tugging at the posterior spines, "transverse tension." A marked tension posteriorly with soft bones, but fast symphysis, would result in the approach of the symphysis to the promontory. But this is counteracted by the pressure of the heads of the femora in the acetabula.

which forces the bones upward and inward. Let us call this pressure "lateral pressure" (Figs. 571 and 572).

Transverse tension would be increased by the active growth of the sacrum in the breadth. Lateral pressure would be increased by the carrying of heavy

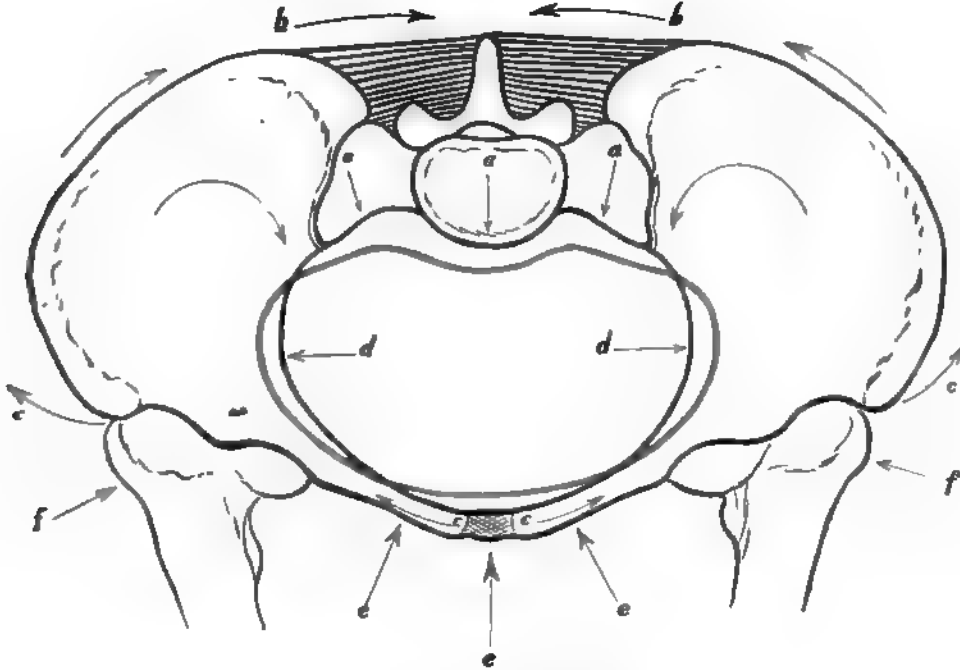


FIG. 571.—DIAGRAM TO ILLUSTRATE TRANSVERSE TENSION AND LATERAL PRESSURE.

a, a, a, Trunk pressure; b, b, drawing together of posterior superior spines; c, c, c, tendency of ilia to part; d, d, transverse tension or thrust, the result of c, c, c, c; e, e, e, resultant flattening of pelvis; f, f, lateral pressure exerted by the femora, which tends to counteract d, d.

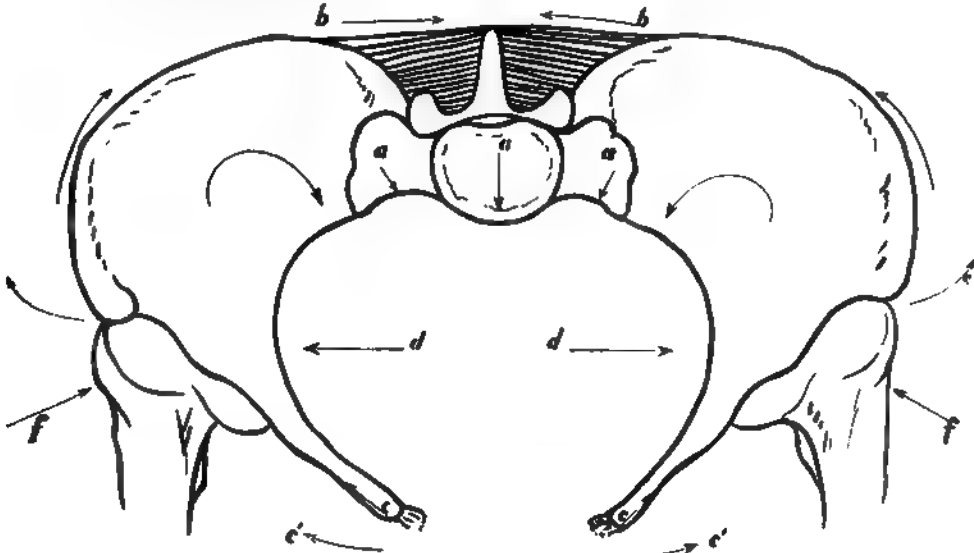


FIG. 572.—DIAGRAM TO ILLUSTRATE ACTION OF TRUNK PRESSURE IN CAUSATION OF FLAT PELVIS. (Lettering same as Fig. 571.)

The weight of the trunk falls on the sacrum, as is indicated by the arrows a, a, a. As a result, the sacrum, which has no wedge action, tends to fall downward and inward into the plane of the inlet. This tendency is resisted by the vast sacro-iliac ligaments, b, b, and the posterior superior spines of the ilia, to which they are attached, tend to come together. If the pubic joint were open, as in Fig. 572, the rami pubis would tend to separate more and more, a condition which is actually observed in the rare cases of split pelvis. Since the symphysis prevents the division of the ends of the pubes, the resultant of all the forces is to cause the symphysis to approach the promontory. To a certain extent the lateral inward pressure exerted by the femora, f, f, counteracts this flattening action of the trunk pressure.

weights during the formative period. All these mechanical results would be generated if the resistance of the bones and cartilages were reduced, as in rickets and osteomalacia, or removed, as in split pelvis.

Muscular action has a decided influence on the formation of the pelvis. For example, the outward rolling of the lower edges of the descending rami of the pubis is probably due to traction by the adductores femoris.

A harmonious operation of all the above factors is necessary for the production of the normal pelvis, and, in the study of the pathologic, we shall see how abnormal tendencies of growth, abnormal application of the body pressure, reduced vitality, disease of the bones and joints, etc., produce distorted pelvises.

**Classification.**—Scientifically, the best way to classify abnormal pelvises is according to their etiology or pathology. Kolisko presents 12 different systems proposed by various German, English, and French authors since 1840, but none of them, that all, including his own, are unsatisfactory. This is because the general pathology of most of the pelvises is either unknown or not universally agreed so that they can be given a settled place in any classification, and, further, a classification that would suit the anatomist would not aid the obstetrician in his daily practice. The latter would prefer a system based upon the dimensional and morphological characters of pelvises, because these are what he has to consider at the birth. Litzmann, in 1861, proposed such a classification, and nearly all obstetricians since have adopted it, at least as a basis for their presentation of the subject.

#### LITZMANN'S SYSTEM

- I. *Pelvis with normal shape*, but either too large or too small:  
Pelvis æquabiliter justomajor and justominor.
- II. *Pelvis with abnormal shape*:
  - (a) Flat pelvis.
    1. Simple.
    2. Rachitic.
    3. Generally contracted, flat pelvis.
  - (b) The transversely contracted pelvis.
  - (c) Irregularly contracted pelvis.
    1. The scoliosis.
    2. The coxalgic.
    3. Amputation.
    4. Dislocation of femur.
    5. Asymmetric sacrum, as the Naegelè pelvis, tubercular hip disease, etc.
  - (d) Crushed together pelvises, the osteomalacic and pseudo-osteomalacic pelvises.

#### SCHAUTA'S SYSTEM

- I. The results of developmental anomalies.
  1. Generally contracted, not rachitic, pelvis.
    - (a) Infantile pelvis.
    - (b) Masculine pelvis.
    - (c) Dwarf pelvis.
  2. Simple flat, not rachitic, pelvis.
  3. Generally contracted flat, not rachitic, pelvis.
  4. Funnel-shaped pelvis, fetal type.
  5. Insufficient development of one wing of the sacrum (Naegelè).
  6. Insufficient development of two wings of the sacrum (Robert).
  7. The generally too large pelvis (justomajor).
  8. The split pelvis. Absence of closure of the symphysis pubis.
- II. Anomalies the result of diseases of the pelvic bones.
  1. Rachitis.
  2. Osteomalacia.
  3. Neoplasms.
  4. Fracture.
  5. Atrophy, caries, and necrosis.
- III. Anomalies of the pelvic joints.
  - (a) Synostosis of one or more.
  - (b) Softening of one or more.
- IV. Anomalies caused by diseases of the trunk.
  1. Spondylolisthesis.
  2. Kyphosis.
  3. Scoliosis.
  4. Kyphoscoliosis.
  5. Assimilation.

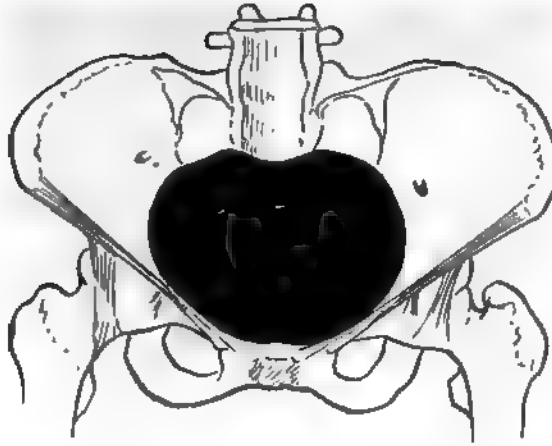


Fig. 573.—Normal pelvis.

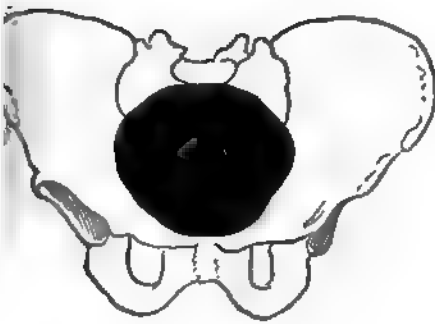


Fig. 574.—Generally contracted pelvis.

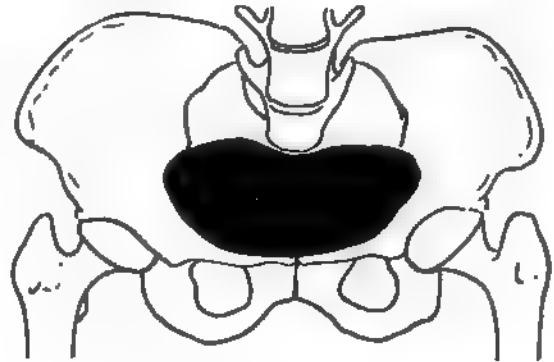


Fig. 575.—Flat pelvis.

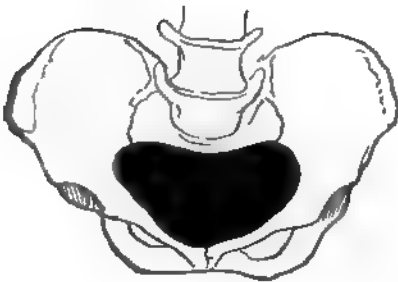


Fig. 576.—Flat and generally contracted pelvis.



Fig. 577.—Transversely contracted pelvis.

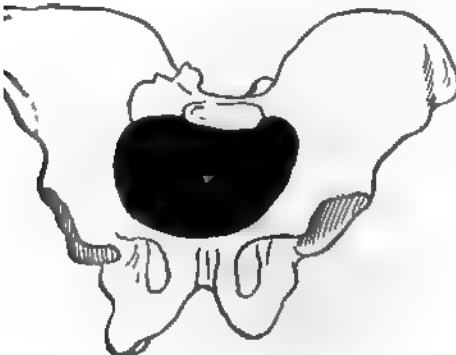


Fig. 578.—Obliquely contracted pelvis.



Fig. 579.—Crowded together pelvis.

Figs. 573-579.—DIAGRAMS TO SHOW THE VARIETIES OF DEFORMED PELVES, ALL DRAWN FROM SPECIMENS OF THE NORTHWESTERN UNIVERSITY MEDICAL SCHOOL.

- V. Anomalies the result of diseases of the supports of the pelvis.
1. Coxitis.
  2. Dislocation of one or both femora.
  3. Club-foot.
  4. Absence or inefficiency of one or both legs.

#### TARNIER.—BUDIN.—BONNAIRE.

- I. Deformities due to excess of malleability of the bony tissue.
  - (a) Rachitic pelvis.
  - (b) Flat, non-rachitic pelvis.
  - (c) Osteomalacic pelvis.
- II. Anomalies in the application of the spinal pressure.
  - (a) Lordotic pelvis.
  - (b) Scoliotic pelvis.
  - (c) Kyphotic pelvis.
- III. Anomalies from displacement of the spinal column, spondylolisthetic and spondylolizematic pelvis.
- IV. Anomalies due to misapplication of femoral counterpressure.
  - (a) Unilateral lameness.
  - (b) Bilateral lameness.
- V. Anomalies of the initial development of the bones of the pelvis.
  - (a) General large and small pelvis.
  - (b) Local and asymmetric, oblique oval pelvis.
  - (c) Local and symmetric, double oblique oval, split pelvis, arrest of development of sacrum, etc.
- VI. Atypical deformities, as tumors, fractures.

It must be remembered that several causes can combine to produce a pelvis which may be fitted into no classification—for example, a child born with a dislocation of one hip becomes rachitic, or a rachitic child develops a tubercular hip, etc. If the deforming disease appears late in life, the pelvis is altered in a way differing from that resulting from early changes; variations in degree of deformity, also of location, occur, and these, with many other factors, sometimes produce pelves of most bizarre shapes and irregular sizes.

**Too Large Pelves.**—Dystocia may arise from the pelvis being too large, and usually this is found in large women, but as these, as a rule, have big babies, the proper proportion is reestablished. Often enough a large, apparently well-built woman will have a difficult delivery, even resulting in the death of the child, and on investigation the accoucheur is surprised to find a large inlet, but with a small pelvic outlet, that is, a large funnel-shaped pelvis. If the pelvis is too large, all the diameters exceeding the normal by 2 cm. or more, the mechanism of labor may be influenced. During pregnancy the head sinks low down and causes pressure symptoms in the bladder and rectum. In labor the soft parts are exposed to the full force of the powers, and often tear or stretch too much, permitting the rapid exit of the fetus. Subsequent relaxation of the pelvic floor and prolapse of the uterus may result. Flexion and rotation of the head are not so marked, and occipitoposterior positions are common—all of which may cause serious dystocia if not promptly recognized. It has seemed to the author that such women have a tendency to postpartum hemorrhage.

**Anomalies of pelvic inclination** may cause dystocia by influencing the direction of the uterine axis. Engagement of the head may be delayed by too great inclination, and the pelvic floor is endangered by the direct pressure of the head when the outlet lies in a way to receive the full force of the uterine action. On the living it is very difficult to measure the pelvic inclination, except with Neuman and Ehrenfest's complicated cliseometer, but the skilful accoucheur can usually discover the abnormality if it is causing dystocia, and, by raising or lowering the parturient's trunk, bring the axis of the uterus into parallelism with that of the pelvic canal.

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*Breus und Kolisko:* Die pathologische Beckenformen. Five volumes, 1900–1912.

## CONTRACTED PELVIS

**Definition and Frequency.**—Authors generally state that a pelvis which shows a diminution of  $1\frac{1}{2}$  to 2 cm. in an important diameter should be called contracted, but clinically every pelvis should be so designated when it is certain that the anomaly has produced a disturbing influence on the parturient function. It is also a general practice, since contraction at this point is the most common, to use the conjugata vera as the determining diameter, and to say that a pelvis is contracted when the conjugata vera is shortened, and, too, the degree of the contraction is measured by the amount of the shortening of the conjugata vera. Thus Michaëlis, who really founded the scientific obstetric study of pelves, placed the beginning of contracted pelvis at a 10 cm. C. V. in the justominor types, and at 9.5 cm. in those of the flat variety.

Litzmann, who published Michaëlis' posthumous book, proposed four grades, according to the length of the conjugata vera, thus: If the conjugata vera was less than 5.5 cm., absolute contraction; a second degree, from 5.5 to 7.3 cm., a third degree, from 7.4 to 8.3 cm., and a fourth, 8.4 cm. to normal. Schröder proposed a simpler division. As the shortest conjugata vera which would permit the delivery of a normal-sized child through the natural passages 6.5 cm. was set, and pelves smaller than these were called *absolutely* contracted. If the conjugata vera was from 6.5 to 9 cm. long, the pelvis was called *relatively* contracted, because a living child could be gotten through in a large proportion of cases, and a mutilated fetus always. A third grade took in those with a conjugata vera from 9 cm. to the normal, and labor in these cases was complicated more often by errors of mechanism than by spacial disproportion between head and pelvis. These measurements applied to flat pelves. In generally contracted pelves, since there is diminution of all the diameters and the area of all the planes is smaller, 0.5 cm. is to be added to the upper limit of each division.

A moment's thought will show how artificial and futile such, or any, division of pelves is, but for purposes of description and discussion some standard must be used, and this one is the best of all yet proposed. The size of the child, the hardness and moldability of its head, the presentation, position, and attitude, all make the pelvis smaller or larger as far as the question of spacial relations is concerned. Add to this the difficulty of measuring the pelvis and the inaccuracies always present, and it becomes apparent why authors vary so much in their estimate of the frequency of contracted pelves and in the division into degrees or grades of obstruction.

In Germany, considering a pelvis contracted when the main diameter is  $1\frac{1}{2}$  to 2 cm. shortened, it is estimated that from 14 to 20 per cent. are thus to be designated, and, considering contraction to exist only when serious dystocia results, 3 to 5 per cent. One element of irregularity is the lack of standardization of contracted pelves.

One author reports all pelves contracted with a conjugata vera less than 10 cm., another with less than  $9\frac{1}{2}$  cm., another uses the conjugata diagonalis and calls all pelves contracted with a conjugata diagonalis less than  $11\frac{1}{2}$  cm. Another author relies on the external measurements, and we already have shown how uncertain these are. Statistics collected by Dohrn in 1896 show a total frequency varying from 5 to 27 per cent. In Austria a variation of from 2.15 to 16 per cent. exists; in Switzerland, 7.9 to 20.07 per cent.; in Holland, 3.51 to 33 per cent.; in the United States, 11.45 to 25 per cent. (Dobbin, Williams, Flint, Davis).

These figures carry the stamp of unreliability on their faces. Most of them were collected in clinics, to which a large proportion of obstructed labors is brought,

which, of course, increases the percentage, and the others are from out-maternities, in which only those cases exhibiting delay in labor are accurately measured, or, practising among the poor, disclose a higher proportion of deformities than the whole community would show. In America it is impossible to obtain accurate information of the frequency of pelvic contraction. In American-born women it is undoubtedly rare, many practitioners in such communities meeting hardly one or two in a lifetime's practice. Milder degrees, insufficient to provoke serious dystocia, are perhaps unobserved, the delay in labor being ascribed to malpositions, etc. Among our foreign-born and colored population high grades of contraction are not infrequently observed, but here again statistics furnished by the obstetric specialist and the clinic or the hospital are useless, because the difficult labors are referred to these institutions and swell the percentages.

Still greater uncertainty exists regarding the frequency of the various forms of contracted pelvis. It seems to the author that the abnormal pelvis most commonly met with in general practice is a mild degree of the funnel, infantile, or masculine type. In consultations on obstructed labor the generally contracted has been more frequently encountered than the flat type. Williams noted the latter in one-third of the cases in white, and two-thirds in colored, women. In Germany the simple flat and rachitic flat pelvis predominate, but even there the authors are not agreed. Osteomalacia is exceedingly rare in America.

#### THE GENERALLY CONTRACTED PELVIS

Other names for this type of anomaly are: Pelvis *aequabiliter justominor* (Stein); pelvis *nimis parva* (Deventer, who first described it). Several varieties are to be considered: The simple, equally contracted pelvis, the infantile, the masculine, and the dwarf. Fig. 580 shows an equally contracted pelvis. It has beautiful lines, and is a normal pelvis in miniature. This pelvis is found in women of small stature and gracile, never in large women, and is in proportion to the rest of the skeleton. All its diameters are shortened, though rarely is the relation of the *conjugata vera* to the others absolutely correct—usually a slight flattening exists. This seems to indicate that perhaps rickets had something to do with the production of the general hypoplasia. Fig. 582 shows a justominor pelvis of the infantile or juvenile type. The inlet presents an anteroposterior oval; the sacrum is high and long; the pelvic inclination marked. Compare it with Fig. 570, a child's pelvis. This pelvis is deep, and the tuberosities are close together, giving the excavation a funnel shape. A woman bearing this pelvis will have narrow hips, the female escutcheon (the hairy portion of the *mons veneris*) will be long, narrow, and sparsely covered, the posterior superior spines of the ilia close together, the rhomboid of *Michaëlis* short and narrow, the labia majora small and undeveloped, the same being true of the breasts, and altogether the person will show a child's habitus. *Frigiditas sexualis*, sterility or pregnancy late in marriage, and other general evidences indicate that the individual was not completely developed.

If the bones are very heavy and thick, the cavity of the pelvis may be encroached upon and the pelvis may partake of the characters of the male. The sacrum is long and narrow, the arch of the pubis high, the sides of the pelvis close together, and the inlet even an anteroposterior oval. This masculine type of contracted pelvis will be again mentioned under funnel pelvises.

Minor degrees of general pelvic contraction are very common—those with a *conjugata vera* between 9 and 10 cm. are moderately rare, while those below 9 cm. are almost always combined with rachitis, the dwarf pelvis alone showing a true conjugate of 7 cm. or less.

Dwarf pelvis are very rare in this country. Breus and Kolisko distinguish five varieties of dwarfs:

1. The chondrodystrophic dwarf, the result of *achondroplasia foetalis*, which formerly was



- called congenital rickets. The development of the long bones is hindered by pathologic changes in the epiphyseal cartilages (Kaufman), but the head and chest may be well formed. A tendency to obesity is the rule. In the author's case the ovaries were as large as hen's eggs and through and through cystic. Is it possible that the changes in this organ had something to do with the production of the bony deformities and the obesity, both of which began in the tenth year?

The pelvis of such a dwarf is usually very small and flat, but signs of rachitis are absent. The flattening is due to insufficient development of the iliac portions of the ossa innominata (Fig. 584).

- 2. In the "true" dwarf pelvis growth ceased at an early period of life and the pelvis shows it, the ossification of all the pelvic synostoses being absent, and the pelvis itself retaining infantile shape and characteristics. Of the two such female dwarfs known, Boeckh's is the one usually

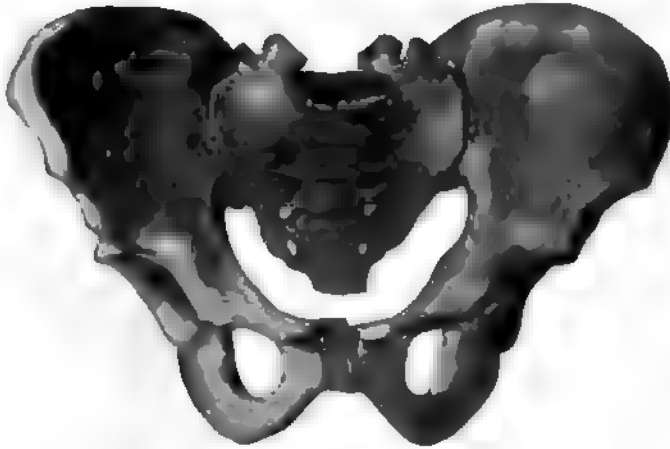


FIG. 580.—PELVIS JUSTOMINOR (author's collection).

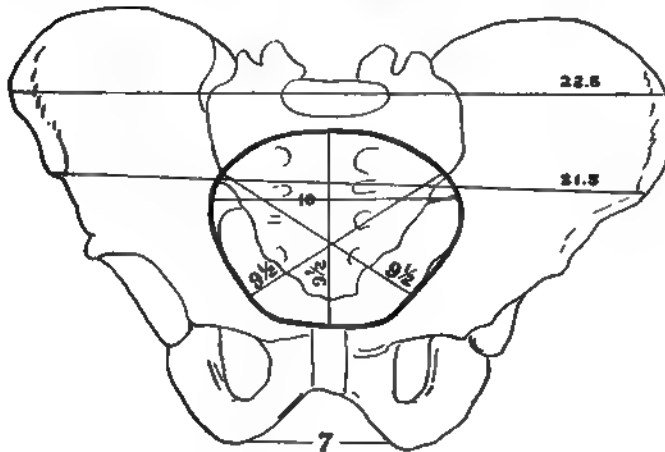


FIG. 581.—PELVIS JUSTOMINOR. MEASUREMENTS OF FIG. 580.

described. Her age was thirty-one years, height, 108 cm., conjugata vera, 8.6; transverse diameter, 9.5.

3. Cretins often have dwarf pelvis. They are characterized by general lack of development of the bones and delay or absence of ossification of many of the epiphyses, the latter point differentiating them from true dwarfs, where all the epiphyses fail to fuse, even very late in life. A cretin's pelvis is often flat, with thin bones, but thickened junctions of the ossification areas; the foramina are large, and the sacrum is short and well curved. Other evidences of insufficient thyroid secretion are always present.

4. Rachitic dwarfs are of two kinds—first, those showing general hypoplasia due to disease; second, those reducing the size of the individual by the excessive bending and shortening of the long bones. Only the first kind should really be called dwarfs, because here the bones are actually shorter and, in addition, bent in a moderate degree. The pelvis of such individuals come under the classification of generally contracted flat pelvis (q. v. Fig. 585).

5. Hypoplastic dwarfs are persons whose whole skeletal system shows a quantitative restriction in growth. This may be combined with rickets. The author has observed it in the late development of very premature infants.

**Causation of Justminor Pelves.**—Little is positively known about the cause



FIG. 382.—GENERALLY CONTRACTED PELVIS. INFANTILE TYPE (Chicago Lying-in Hospital Museum).

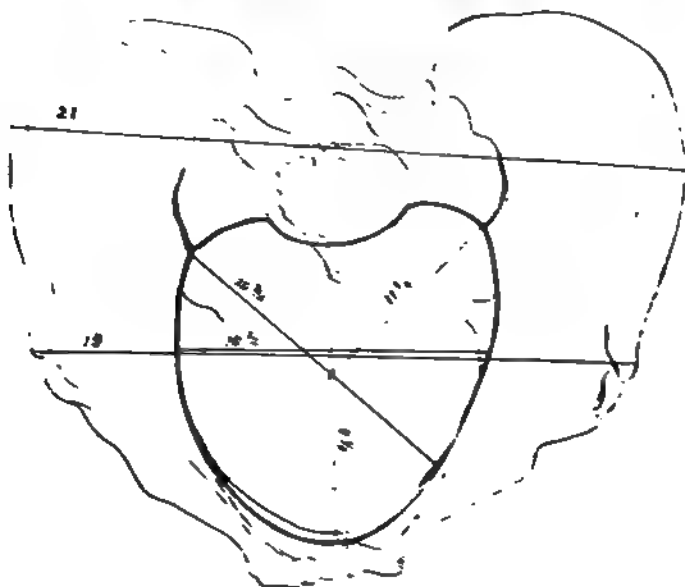


FIG. 383.—MEASUREMENT OF FIG. 382.

and their manner of action, but these may be mentioned as having some influence: heredity; small parents; prematurity at birth; bottle-feeding; marasmus; improper hygiene at the time of puberty; overcrowding the growing girl with

lies, social demands, etc.); improper dress. Four sisters in the author's practice have generally contracted pelvis, and symphysiotomy, induced labor, craniotomy, and forceps have been rendered necessary in their labors. Since the ovary and thyroid are known to have an influence on the osteogenetic processes, we may look to their pathology for the explanation of some of the cases.

**Diagnosis of Justominor Pelvis.**—All the external pelvic measurements, including the circumference, are smaller than normal, but it is not safe to diagnose vic contraction on these figures, because the canal may, nevertheless, be very narrow. The stature of the patient is usually small, but a large woman may have



FIG. 584.—PELVIS OF CHONDRODYTROPHIC DWARF.  
The femur is nine inches long.



FIG. 585.—PSEUDO-OSTEOMALACIC (RACHITIC) DWARF  
(Northwestern University Medical School).

heavy pelvis of the masculine type, with a much reduced lumen. The rhomboid of Michaelis is small and short. Women with infantile pelvis show other evidences of hypoplasia—small face, small breasts, long thorax, visceroptosis, straight spine, small vulva, narrow hips, and generally one gets the impression of a grown-up child. Dysmenorrhea, sterility, and neurasthenia are frequent symptoms.

On the internal examination the general reduction of all the diameters will make the diagnosis, and only on these may reliance be placed. The sides of the pelvis are very easily reached with two fingers, and one can often palpate the linea terminalis throughout its entire length. The spines of the ischia are close together; the tuberosities usually still closer, and the arch of the pubis narrow.

**The Flat Pelvis (Pelvis Plana)** (Fig. 586).—This is a pelvis contracted in the anteroposterior diameters, and many authors distinguish two kinds—the simple flat and the rachitic flat. The writer is inclined to the opinion expressed by Ahlfeld and Sellheim, Breus and Kolisko, that the so-called “simple flat” pelvis is really rachitic in origin. The absence of the characteristic rachitic landmarks on the pelvis induced Betschler, who first described it, and Michaelis to separate it from those of known rickety origin. It was believed that the carrying of heavy weights in early childhood or putting the child too early on its feet caused the simple flattening of the pelvis, but in all probability the cause, if not due to rickets, will be found in the abnormal

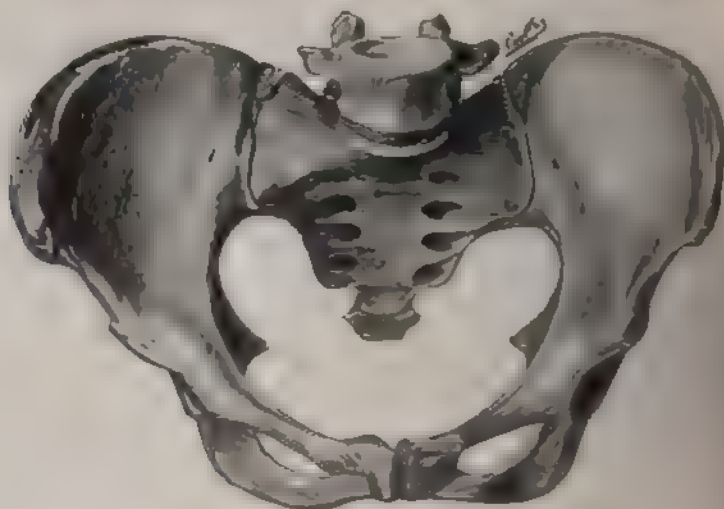


FIG. 586. SIMPLE FLAT PELVIS, ANTERIOR VIEW.

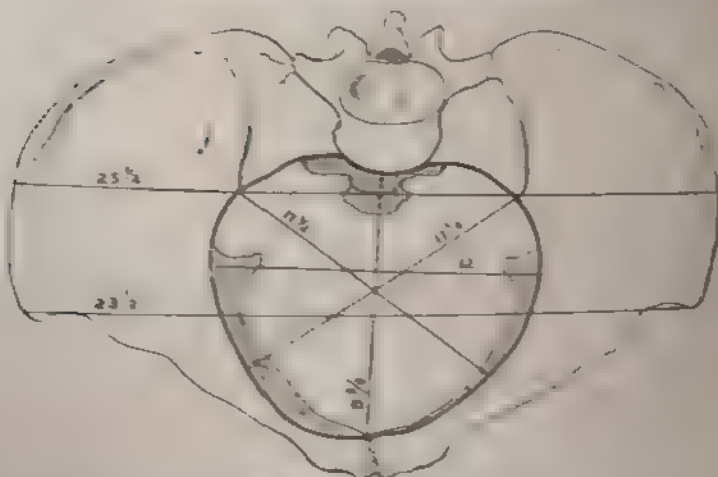


FIG. 587. SIMPLE FLAT PELVIS.

tendency of growth of the bones. In all respects save two the simple flat pelvis looks like a normal one—the sacrum has sunk downward and forward, giving it more a heart-kidney-shaped outline, and the pelvic cavity also is greatly flattened. Nevertheless this pelvis never is largely contracted, and that it never enters into labor. There is no widening of the outlet and the distance between the symphysis pubis is less than the usual relation to that between the spines. Among the large number of the pelvis of the Northwestern University Museum, which I have seen, I have found that not at the same time show posterior contraction of the pelvis. Flat rachitic pelvis are not rare in any obstetric museum. Fig. 580

are smaller and thinner. Rarely the bones are heavier. The ilia flare outward and are flattened so that the distance between the anterosuperior spines is equal to, or greater than, the distance between the crests. The pelvic inclination is increased, the pubic arch broad, the angle which the pubis makes with the inlet obtuse, the tuberosities widely separated, and the acetabula look more anteriorly than is normal. This peculiar insertion of the femora gives the patient a remarkable gait, the feet being thrown outward. The most characteristic changes are shown by the sacrum. This bone is forced downward into the pelvic cavity; the concavity of its anterior face is changed in both directions, so that it becomes flat,

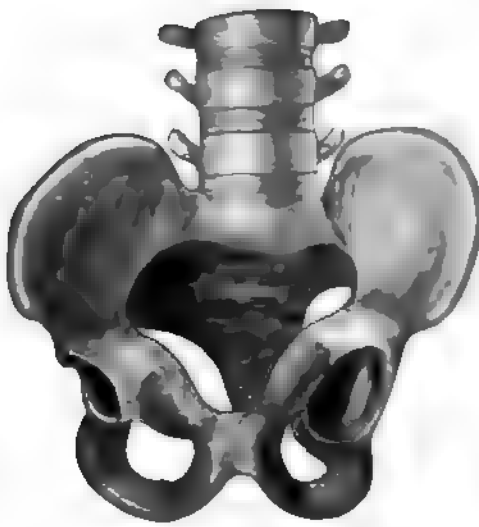


FIG. 591.—PELVIS OF NEW-BORN GIRL, SHOWING RACHITIS (Northwestern University Medical School Museum).



FIG. 592.—PELVIS OF RACHITIC GIRL AGED THREE. Had the child lived, her pelvis would probably be like Fig. 593.

and in advanced cases convex from side to side, and straight from above downward, the bodies of the sacrum protruding from between the wings, and the sacrum being bent on itself. A second, or false, promontory is sometimes found below the true one (Fig. 589). Important alterations result in the shape and size of the pelvic canal, most prominent of which is the flattening of the inlet from before backward. The inlet may have the shape of a kidney, and the highest degree of contraction may exist in the conjugata vera. The transverse and oblique diameters may be normal or even larger. The true pelvis is shallow, the outlet usually much enlarged (Fig. 590), and this gives labor a character different from that in generally contracted pelves. In the latter, because the pelvis is usually uniformly contracted

throughout the length of the canal, the head has to overcome resistance all the way while with the flat pelvis, after the inlet has once been passed, the rest of the passage is quickly and easily traversed. Rachitic pelvis often show exostoses on the posterior surface of the symphysis pubis. One of my cases had such a bony prominence 10 mm. high.

Mechanical factors have been invoked to explain the formation of the rachitic pelvis, but do not forget that the inherent tendencies of growth, perverted by the disease of the bone, have much to do with it. When the rachitic child sits or stands, the trunk pressure forces the sacrum downward into the pelvis, tilting the promontory forward, increasing the transverse diameter and drawing the pubic symphysis backward, as is shown in the diagram (Fig. 571). The lower end of the sacrum may not recede backward because of the strong sacrosacral ligaments; the sacrum, therefore, is bent in its lower portion, and the bony edge of the sciatic notch and the lesser sciatic foramen are much developed. The lateral pressure of the heads of the femora, acting on the softened bone, tend to force the acetabula inward, as is clearly shown in Fig. 571. In advanced cases the pelvis is pressed together from all sides, as in Fig. 593, presenting the shape



FIG. 593.—PSEUDO-OSTEOMALACIC PELVIS (Northwestern University Medical School Museum).

of the pseudo-osteomalacic pelvis, and is called "pseudo-osteomalacic pelvis." That these changes are not due to the trunk pressure alone is proved by the occurrence of similar pelvises in newborn children (Figs. 591 and 592). In rickets the osteoid substance near the epiphyses remains unossified for a long time, and, therefore, the bone at these points bends under the influence of the trunk pressure and muscle action. Then, too, the apposition-relations of the various epiphyseal centers are disturbed, and, as a result, when the rachitic disease later abates, nature tries to restore the proper balance in the various lines of ossification. The adult rachitic pelvis, therefore, is the result of the disturbance of bony growth and of the deformation of the pelvis by misdirected or relatively too powerful mechanical forces.

**Diagnosis.**—In the routine history the fact of delayed walking and dentition—when a child, bottle-feeding, etc., may be noted. An inspection of the whole child will not fail to reveal stigmata of rachitis—the square head, distorted chest, rachitic rosary, bowed tibiae and femora, "bow-legs," short and broad feet, etc. The spine is usually scoliotic, Michaëlis' rhomboid low and wide—indeed, it may be a triangle instead, with the base upward. The vulva is usually retroposed because of the exaggerated pelvic inclination. There is so much compensatory lordosis that the hand can be run under the spine when the woman lies on her back. The area between the thighs is broad, the knees are squarer.

The characteristic of rachitis is the flattening of the pelvis, and the experienced accoucheur may feel this at once by grasping the hips in both hands. The distance between the spines of the ilia is usually equal to, or even more than, that between the crests, a fact which also can be determined by palpation; the iliac bones flare out and appear smaller than usual. Baudelocque's diameter is short, running from 19 down to  $15\frac{1}{2}$  cm., and when scoliosis exists too, the external oblique diameters are very unequal, but seldom is there a difference of more than 3 cm.

On internal examination will be noted the shallowness of the pelvic cavity, the startling prominence of the sacral promontory; the projection of the ischiatic

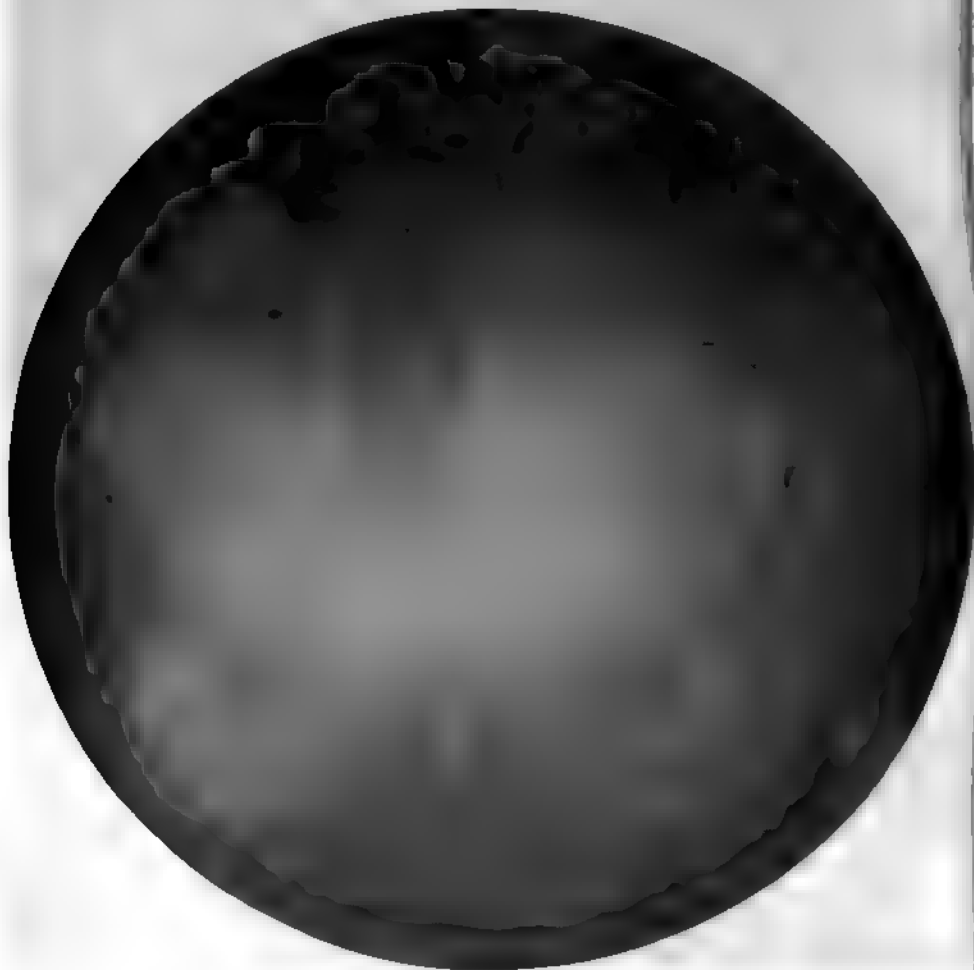


FIG. 594.—MRS. S. X-RAY OF OBLIQUELY CONTRACTED RACHITIC PELVIS.

spines, with the tense sacrosciatic ligaments; the possibility of palpating the linea terminalis all the way, and, near the sacrum, its sharp bend forward; the presence of an exostosis on the posterior wall of the pubis; the low and broad pubic arch, with distant tuberosities of the ischia; the flat or even convex sacrum when palpated from side to side and from above downward (but here one may note that the lower third of the bone is sharply incurved); and the reduced conjugata diagonalis. It is the rule to deduct 2 cm. from the length of the diagonal conjugate to obtain the true conjugate, but this is not always reliable. If the angle which the symphysis makes with the inlet is very obtuse; if the pubis is very high; if there is a high

**x**ostosis or bony ridge on the posterior surface of the pubic joint—it may be necessary to deduct 3 cm. Fig. 594 shows an x-ray picture of a rachitic pelvis. It is of more scientific interest than practical use. The information it gives was more easily obtainable by palpation.

Finally, the course of the labor will often disclose the nature of the pelvic contraction, but this will again be discussed (see p. 713).

#### THE GENERALLY CONTRACTED FLAT PELVIS

When rachitis is very severe and prolonged, the bony growth is so stunted that the pelvis does not attain to normal size. Added to this insufficient development are the deformations of the pelvic bones, the sinking down of the sacrum, etc., all of which combine to produce the generally contracted and flat pelvis. We find



FIG. 595.—GENERALLY CONTRACTED AND FLAT PELVIS.  
Conjugata vera, 5.3 cm. (Northwestern University Medical School Museum).

the smallest pelves in this class, and the inlet may be so narrowed that it will hardly let a six months' fetus pass through (Fig. 595). Rachitic dwarfs have such pelves, and in the chondrodystrophic dwarf pelvis of the author's collection much flattening exists.

#### OBLIQUELY CONTRACTED Pelves

A perfectly symmetric pelvis is a great rarity—as rare as a perfect face or head. One oblique diameter is always a little larger than the other. When this difference in size of the two halves of the inlet is marked, we speak of an obliquely distorted pelvis. Several varieties are to be described, but the general effects of such pelves on pregnancy and labor are about the same.

The most common of the obliquely contracted pelves is the result of scoliosis of the vertebral column, and, of the various forms of scoliosis, the rachitic causes the most marked alterations in the pelvis. Much depends on the location of the curvature, because if it is high up, compensation takes place below, and the effect on the pelvis is hardly noticeable. The rotation of the spinal column and the torsion of the vertebrae are distinguishable in the sacrum when the deformity is located low down. Another point is that the pelvic asymmetry may cause the scoliosis. Fig. 596 shows a pelvis with simple scoliosis, probably due to muscular



weakness. Only the slight flattening indicates the possible rachitic origin. Most cases of such scoliosis are not uncommon, but very rarely do they give rise



FIG. 596.—ASYMMETRIC PELVIS DUE TO SCOLIOSIS FROM MUSCULAR WEAKNESS (Northwestern University Medical School Museum)



FIG. 597.—ASYMMETRIC PELVIS FROM INFANTILE PARALYSIS. Also shows high analization (Northwestern University Medical School Museum). Note difference in size of fem

tocia. Fig. 597 shows a pelvis with a large lumen, but distorted as the result of scoliosis due to infantile right spinal paralysis. It is easy to see that the bones of that side are smaller than the healthy side.

Fig. 598 shows a pronouncedly rachitic pelvis, the flattening of the inlet, the tilting and frontal rotation of the sacrum, the development of the spines, the widening of the ilia, all being well in evidence. Common to all these pelvises are these points: (1) The inlet is smaller on that side to which the convexity of the lumbar scoliosis points, this being due to the fact that the sacrum is pushed over onto that side, and, the trunk pressure being greater here, the sacrum sinks lower; (2) since the trunk pressure comes to bear on one wing of the sacrum more than on the other,

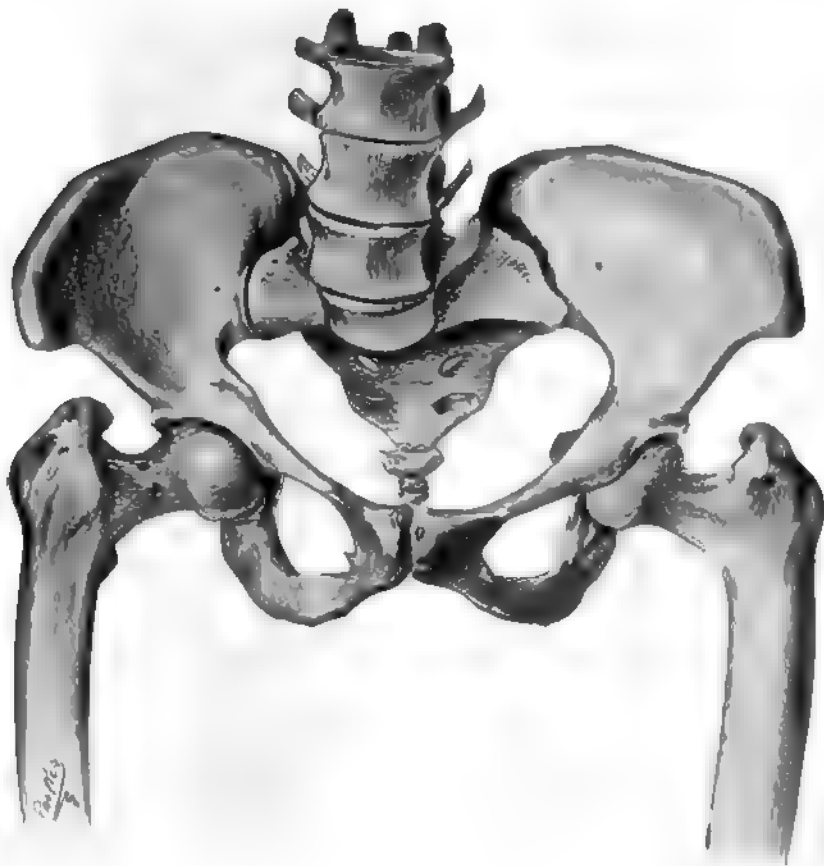


FIG. 598.—OBLIQUELY CONTRACTED FLAT RACHITIC PELVIS.

part of the bone which suffers the pressure is less well developed, the foramina are smaller and closer together, even the iliac portion of the sacro-iliac joint sometimes taking part in this atrophy; (3) the pelvis is tilted so that the more contracted side is higher than the larger side; this is due to the fact that the line of direction the body falls, not through the middle line of the sacrum, but to the side, away from the greatest convexity of the scoliosis; this throws the weight of the trunk almost entirely on one leg, and, therefore, this femur is forced upward, inward, and backward; (4) the sciatic notch is narrowed; (5) the arcus pubis points to the contracted side; (6) the conjugata vera runs obliquely backward; (7) the obstetric conjugate diameter is always shortened; (8) the oblique diameters are very unequal; (9) one ischial tuberosity is higher than the other.

**The Coxalgic Pelvis.**—Disease of the hip-joint in infancy almost always leaves marked pelvic deformity, but rarely does sufficient encroachment on the lumen result to cause serious dystocia. Fig. 600 shows a coxalgic pelvis. Since the diseased side of the pelvis is painful, the patient throws all her weight on the well side, and, as a result, the head of the femur flattens this half of the pelvis and the whole pelvic girdle is distorted. The bones of the diseased side are smaller because of atrophy from disuse of the muscles, and, owing to irregular muscular and ligament traction, the diseased half of the pelvis is enlarged and pulled outward. Since the patient tries to spare herself pain by keeping that leg off the ground, she pulls up the diseased side of the pelvis, which, therefore, is higher than the well side—an action which is aided by the crutch worn under the corresponding axilla. The asymmetry of the pelvis obtains throughout the whole pelvic canal, the tuberosity of the ischium of the affected side being usually drawn upward and outward.

Similar pelvic changes, but less pronounced, occur with tuberculosis of the knee, amputation of the thigh, or other disturbance of function of one limb.

**Naegle Pelves.**—One of the most typical of this class of pelvis—the obliquely

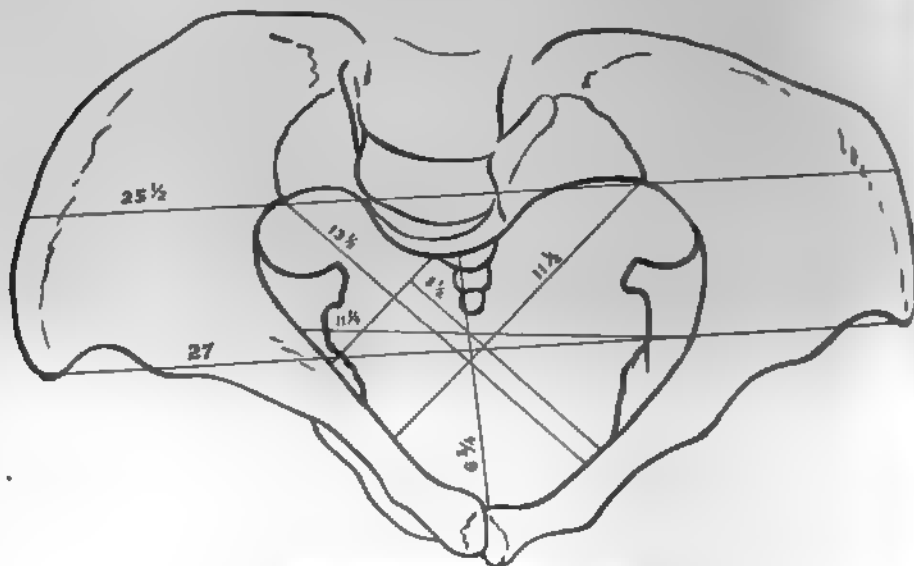


FIG. 599.—MEASUREMENTS OF FIG. 598.

contracted—is that due to disease of the sacro-iliac joint and the neighboring portions of the ilium and the sacrum. F. C. Naegelè, in 1839, first described it, having collected 37 cases, but it was mentioned by various obstetric writers long before this, and Naegelè found one in an Egyptian mummy.

All the findings of oblique contraction, and those due to exaggerated pressure of one thigh, are present in this pelvis, and since one wing of the sacrum is often atrophic, aplastic, or even missing, in addition to the distortion actual reduction in the size of half of the pelvis is present, and, what is important from a clinical point of view, the narrowing of the pelvic lumen extends down to the very outlet. The innominate bone of the affected side is dislocated upward and backward, while the pubic joint is pushed to the healthy side. The linea terminalis of the healthy side is given an exaggerated curve, being straightened on the diseased side. In nearly all cases a firm synostosis is found in the affected sacro-iliac joint, and a sharp polemic was waged among the students of this pelvis as to whether this was primary or secondary. Naegelè believed that, most likely, a primary congenital deformity of the joint existed, and he did not deny that the entire change could be due to



FIG. 600.—COXALGIC PELVIS.

Note that the left hip is elevated, to keep pressure off the tender joint. Right femur has pressed in that side of pelvis. Note the right scoliosis and compensating left, with the torsion of the spinal column, indicated by arrows.

FIG. 601.—OUTLET OF COXALGIC PELVIS. ANKYLOSIS OF LEFT HIP.

Delivery is best accomplished by placing woman on left side and bringing occiput up over right ramus pubis.



FIG. 602.—NARROW PELVIS. OSTEO-ARTHRITIC TYPE (Northwestern University Medical School Museum)

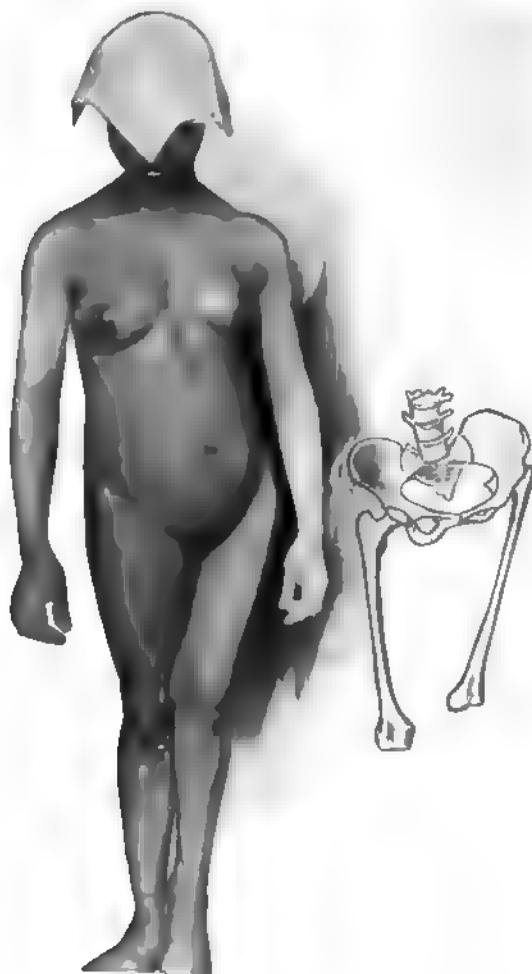


FIG. 603.—L.S.P. COXUS.  
Sketch at side is from a pelvis almost identical with that of the living patient.

ed disease. Hohl proved that the wing of the sacrum could be congenitally t, but other specimens were exhibited which showed that characteristically ned pelves could be produced by acquired disease of the sacro-iliac joint. 02 shows a pelvis from the author's collection, and it presents positive evi- s of disease of the sacro-iliac joint. Disease of the right hip-joint coexists, it which Litzmann emphasizes and draws into the causation of the Naegelè . Breus and Kolisko find traces of ostitis in all so-called Naegelè pelves, sist that the deformity is always due to arthritis, caries, or trauma of the iliac synchondrosis or other portions of the pelvis. Pelves with congenital

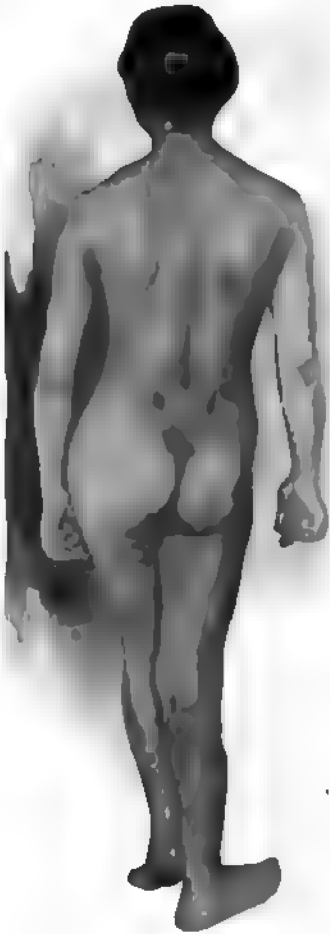


FIG. 604.—COXALGIC PELVIS.  
of the pelvis is shown by the rhomboid of  
Michaelis.

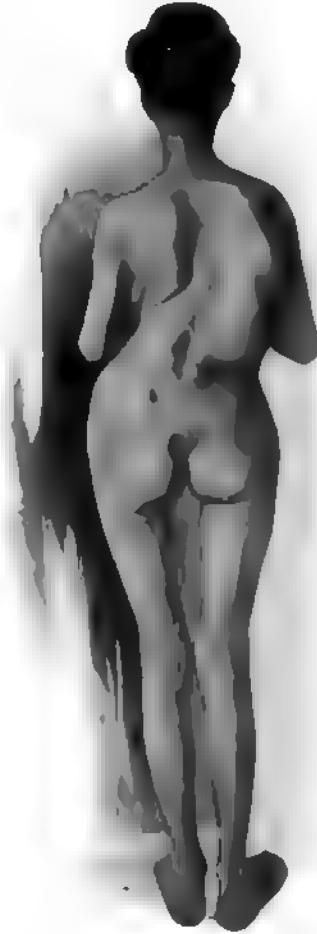


FIG. 605.—SIMPLE SCOLIOtic PELVIS.  
Compensation not complete, and pelvis, therefore, tilted  
as shown by rhomboid. Normal labor.

s of the wings of the sacrum exist, but they do not produce such great de- y of the inlet nor do they show contraction of the whole length of the pelvic as do these pelves with disease of the sacro-iliac joints. Here the sacral iac portions are wasted, absorbed, and ankylotic. If the disease occurs in life, the developmental portions—the ossification centers—are destroyed, owth of the bone, of course, is rendered impossible. Now come the mechanis- tors, the pressure of the trunk, the lateral pressure of the femora, and the teristic changes are brought about.

diagnosis.—It is usually easy to discover an obliquely distorted pelvis, but



Mild degrees of contraction are found in the kyphotic, the infantile, and some varieties of high assimilation pelvis. Contraction of the pelvic outlet is found in the funnel pelvis and those of the masculine type.

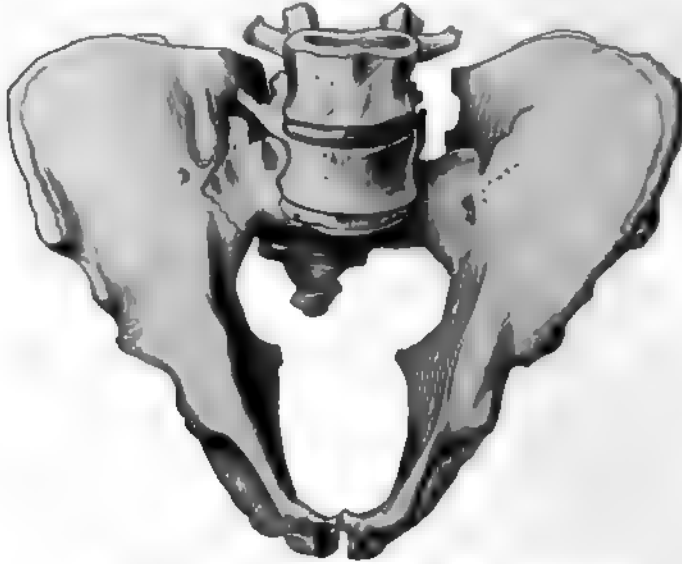


FIG. 608.—ROBERT'S PELVIS (after Robert's Dubois' pelvis in Paris).

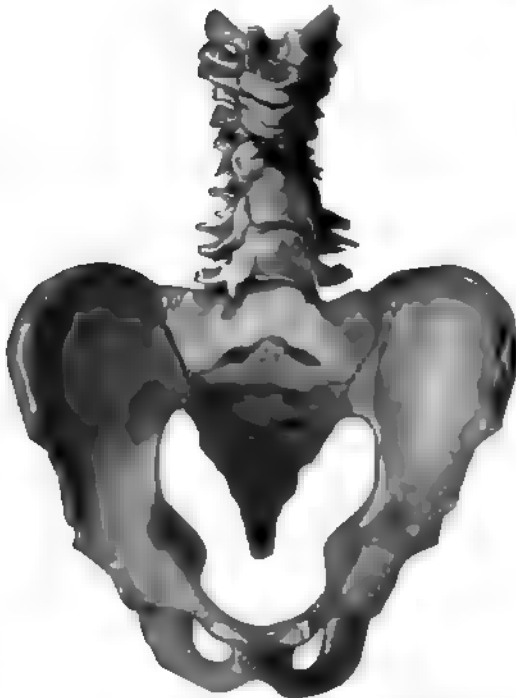


FIG. 609.—KYPHOTIC TRANSVERSELY CONTRACTED PELVIS (after Robert's Dubois' pelvis in Paris).



FIG. 610.—LATERAL VIEW OF SAME.

**The Robert Pelvis.** Only 10 or more of these, the classic transversely contracted pelvis named after Robert, who in 1842 first described it, are in existence. This deformity is due to the same cause which produces the Naeglelè pelvis, the



osteo-arthritis, but acting on both sacro-iliac joints. Both sides of the pelvic inlet are compromised, and the inlet assumes the form of a narrow wedge (Fig.

The narrowing of the pelvis usually extends to the very outlet, and in one described by Breus and Kolisko the distance between the spines of the ischium only 2 cm.

**The Kyphosis Pelvis.**—Fig. 609 shows a pelvis contracted in the transverse diameter, and possessing also some of the characteristics of the funnel type. It is a young girl, ossification still being incomplete. If the kyphosis is situated in the upper part of the spinal column, a compensatory lordosis lower down restores the direction of gravity to its normal position in the statics of the person, and, therefore, the pelvis suffers little, if any, change. If, as in Fig. 610, the "knuckle gibbus" is in the lumbar

region, marked alteration of the position occurs. The sacrum is, therefore, drawn upward and forward of the pelvis; at the same time it rotates on a transverse axis so as to throw the promontory up and back, the coccyx downward and inward. As a result of the rotation of the sacrum the innominate bones are drawn around the sacral articular surfaces, so as to bring the sacrum together and exaggerate the forward dip of the crests, thus, increasing pelvic inclination. This action is produced by the patient throwing the head and shoulders back to counteract the tendency of the body to fall forward when the ligaments of the vertebræ soften and break down under the pressure of the osseous caries (Fig. 612).

The extreme pelvic inclination of these pelves is well understood. The patient throws the lower abdomen forward and holds the head high and the shoulders backward. Pendulous belly is marked in these women in all others.

If the caries of the vertebræ is in the lowest lumbar or in the first sacral vertebra the upper arm of the knuckle comes to lie over the inlet, roofing it over—*spondylozema*, as Herrgott called it, or *pelvis oblecta*, a better term, offered by Fehling. If the inlet may be large, the spinal column roofs it over so that the head cannot enter the pelvic canal.

**The Funnel Pelvis.**—When the lumen of the pelvis grows smaller from the inlet to the outlet, we speak of funnel pelvis. Most pelves of the generally constricted type belong in this class, as do also several of the other varieties already described—the kyphotic, the Naegeli's, the Robert's, and some of the rachitic. The causes of the convergence of the pelvic bones toward the outlet cannot always

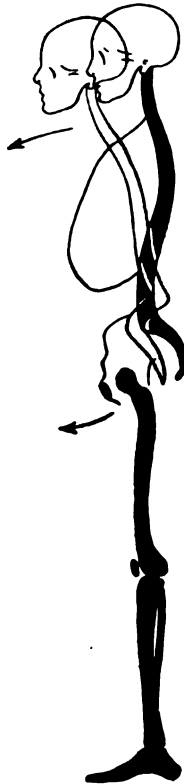


FIG. 611.—NORMAL STATURE, BLACK: KYPHOSIS, RED. BODY FALLS FORWARD AND TO PREVENT TOPPLING, PATIENT THROWS HEAD AND SHOULDERS BACK.



FIG. 612.—SHOWS ROTATION OF TRUNK ON HIP-JOINTS, WITH BACKWARD PROPULSION OF PROMONTORY AND FORWARD MOVEMENT OF LOWER SACRUM.

be determined. Fig. 613 shows a pelvis normal in every other particular, but the sacrum and the ischial portions of the innomates converge toward the outlet. Women of masculine habitus, who have large, leonine features, hirsuties, a tendency to firm obesity, and who are often sterile, frequently have heavy bony funnel pelvis. Infantilism of the genitalia sometimes is associated with funnel pelvis. Williams emphasizes the frequency of high assimilation as a cause of funnel pelvis, and my own observation tends to confirm this view.

High degrees of funnel pelvis are exceedingly rare, but moderate contraction of the outlet is, in the author's experience, a pelvic deformity very commonly met. True this is not usually recognized, the dystocia being ascribed to some anomaly of the soft parts or of the presentation and position, the size of the fetus, or weakness of the powers of labor. Without doubt many of the forceps operations performed for delay in the second stage are necessitated by contraction of the bony pelvic outlet.

*Diagnosis.*—Funnel pelvis of the kyphosis type is easily recognized—the gibbus low down in the back will point to it. Not so easy is the recognition of the mascu-



FIG. 613.—FUNNEL PELVIS (author's collection).

line pelvis, and the attendant is usually only apprised of the latter's existence when a stop in the labor occurs with the head low down in the pelvic canal. If in the routine pregnancy examination the accoucheur will take care to palpate the descending rami of the pubis as in Fig. 275, p. 250, and measure the distance between the tuberosities, as in Fig. 273, such surprises will come to him very seldom. During labor, if the palpation of the side walls of the parturient canal does not indicate narrowing, the pelvimeter used as in Fig. 269 will give positive information. A masculine pelvis may be looked for if the patient is large, with a tendency to firm adiposity, with large leonine features, and hirsuties of the face. Often such women are married late, are sterile for many years, have frigidity sexualis, early menopause, and often develop fibroids. If they do become pregnant, it is often the only reproductive effort (single child sterility), for which reason special care should be exerted to preserve the child.

Schauta found funnel pelvis in about 6 per cent., Stocker in about 26 per cent., and Klien in 24 per cent., of the cases examined.

**Assimilation Pelvis.**—In the embryo the iliac bones develop in the region of the twenty-fifth to the twenty-ninth spinal vertebrae, which five vertebrae later are fused together to form the sacrum. The sacro-iliac joint is usually made with the twenty-sixth spinal vertebra at first, but soon the twenty-fifth and twenty-seventh are involved. If the iliac bones are united with vertebrae higher up in the spinal column, for example, the twenty-fourth, twenty-fifth, and twenty-sixth, we will find the sacrum long and narrow, and the first sacral vertebra presenting the characteristics of the last lumbar. The last lumbar vertebra, therefore, seems to be “assimilated” with the sacrum, and such a pelvis is called “upper assimilation pelvis”—upper, because the union of the ilia with the spinal column is higher up than normal.

If the union of the ilia with the spinal column occurs with the twenty-sixth, twenty-seventh, and twenty-eighth vertebrae, we find a short, usually broad sacrum, and the last lumbar vertebra having many of the characteristics of the first sacral.

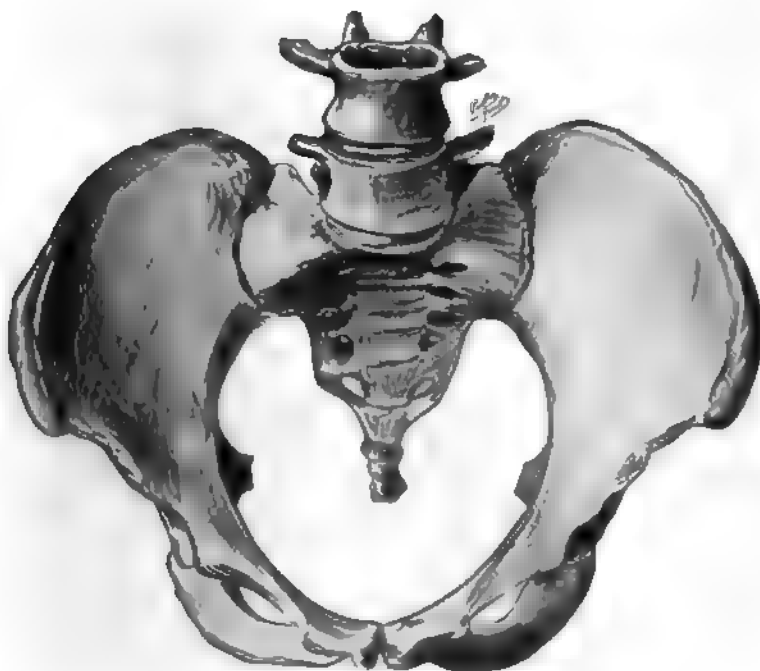


FIG. 614.—HIGH ASSIMILATION PELVIS. ROUND INLET.  
Drawn from a specimen Professor Kolisko gave to the author.

The last lumbar, the twenty-fourth, seems to be assimilated with the sacrum, and such a pelvis is called a “lower assimilation pelvis”—lower, because the union of the ilia with the spinal column is lower than normal.

In many instances the insertion of the ilium is normal on one side and higher or lower on the other, asymmetric assimilation pelvis resulting. Only half of the last lumbar vertebra then goes to help make up the sacro-iliac joint. Scoliosis is a frequent result of this deformity. Unless one has the whole spinal column for study, it may be difficult to determine where the assimilation occurred. Indeed, in many cases it is not easy to recognize the deformity.

Sometimes the coccyx is assimilated with the last sacral vertebrae. This is of little practical importance. Perhaps fracture of the coccyx is more common, and, too, since assimilation sometimes causes funnel and transversely contracted pelvis, the delay in labor at the outlet may be prolonged by the abnormal bony formation, which latter, too, predisposes to fracture.

Breus and Kolisko, of Vienna, to whom we are indebted for the most thorough study of these pelvises, distinguish five kinds: (1) The high assimilation pelvis; (2) the transversely contracted; (3) the midplane contracted; (4) the low; (5) the asymmetric. The terms high and low have nothing to do with the site of the uni-



FIG. 615.—TRANSVERSELY CONTRACTED ASSIMILATION PELVIS (Breus and Kolisko).

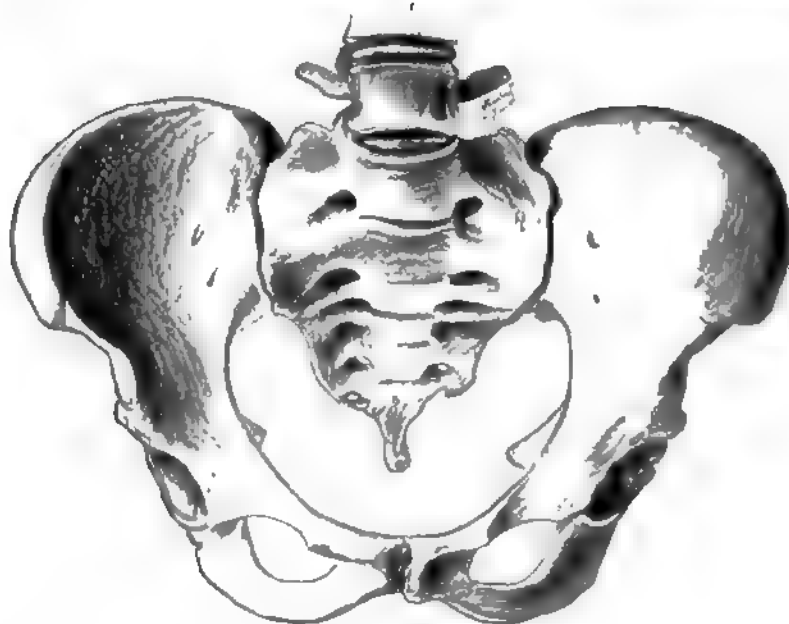


FIG. 616.—MIDPLANE CONTRACTED ASSIMILATION PELVIS (Breus and Kolisko).

of the pelvic girdle with the spinal column, that is, upper or lower assimilation refer to the height of the pelvic canal.

Fig. 614 shows a high assimilation pelvis, which, with those of Figs. 615 and 616, they kindly presented to me. Its characteristics are: a very high promon-

**Long sacrum**, composed almost always of six vertebrae and with five sacral foramina, the first of which may lie above the plane of the inlet; almost perpendicular wings of the sacrum, which are thin; pelvic canal deep, conjugata vera lengthened, conjugata transversa sometimes shortened.

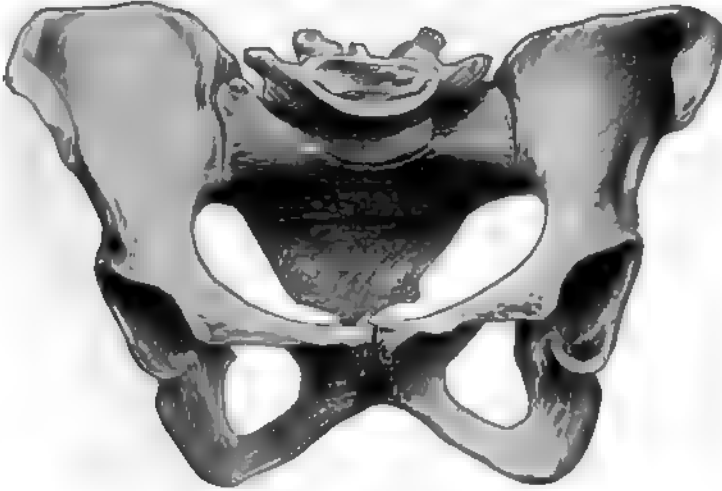


FIG. 617.—LOW ASSIMILATION PELVIS (Breus and Koliako).

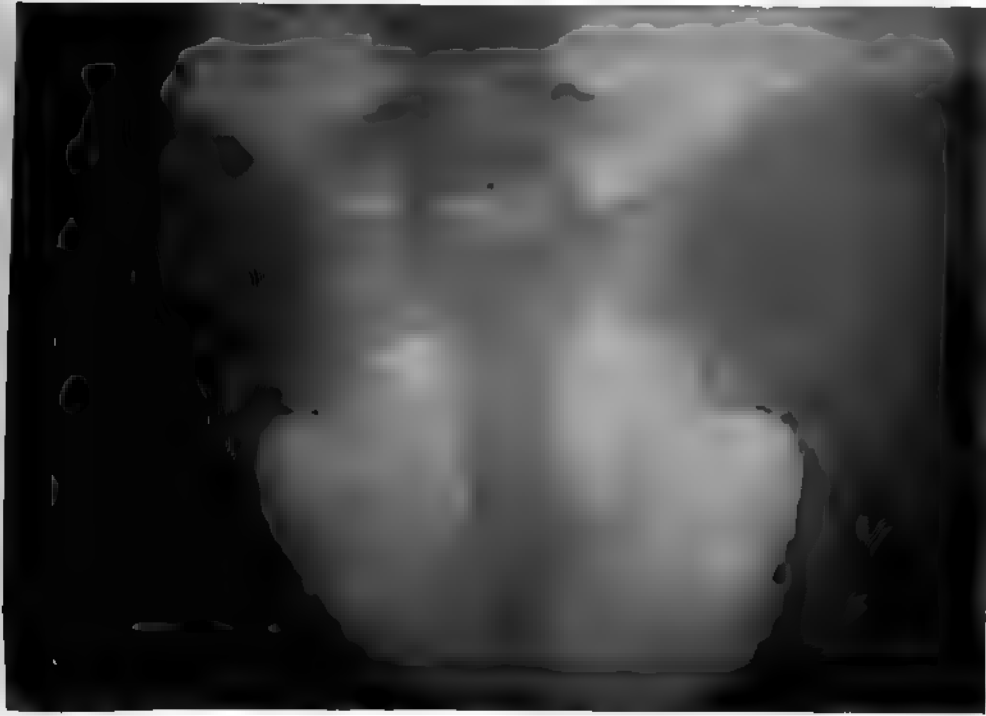


FIG. 618.—X-RAY OF PROBABLE PARTIAL UNILATERAL ASSIMILATION (case of Dr. F. Johnson, at Michael Reese Hospital).

Fig. 615 shows a transversely contracted assimilation pelvis from the same source. The promontory is very high, and another, or double, exists. The sacrum is long and narrow, the wings being poorly developed, and the transverse contrac-

tion may continue downward to the outlet, giving this pelvis a funnel shape or masculine type.

Fig. 616 is one of Breus and Kolisko's midplane contracted assimilation pelvis. The forward prominence of the sacrum is evident, and this causes a shortening of all the sagittal diameters, especially that of the second parallel of Hodge. This pelvis has two promontories, and the uppermost sacral vertebra, carrying the sacral foramina with it, seems to be bent backward, to get into alinement with the lumbar spine. All these pelves have extreme inclination to the horizontal.



FIG. 617.—LOW OR SHALLOW ASSIMILATION PELVIS. (From Breus and Kolisko.)

Fig. 617 shows a low or shallow assimilation pelvis: its promontory is very low and projects forward, the pelvis being shallow, but roomy.

Fig. 597, p. 686, shows an asymmetric assimilation pelvis from the author's collection. It was combined with scoliosis. Since the pelvic lumen is not seriously encroached upon in the assimilation pelves, much practical importance is usually not attached to this deformity by most authors. I am convinced, however, that many of the most frequent causes of arrest, such as occipitoposterior, occipitosacral positions, arrest of rotation in the midplane, deep transverse arrest, extensive pelvic contraction, etc., are due to the irregular shape of the pelvic canal produced by these peculiarities. Transverse contraction can be so pronounced as to

cause real dystocia, and if the child is large, it may die in delivery or even craniotomy may be required.

**Diagnosis.**—It may be possible to feel six sacral vertebrae in exceptionally favorable cases, but usually the diagnosis of assimilation pelvis on the living is only a surmise. When distinct narrowing of the outlet exists and signs of infantilism are absent, one may suspect that such deformity exists. A very high or double promontory with normal measurements is suggestive, and a scoliosis which has no other apparent cause may also lead one to think of assimilation. The x-ray might discover it (Fig. 618).

**Spondylolisthetic Pelvis.**—Kilian, in 1854, first named this pelvis, the term being derived from the Greek, which means a sliding of the vertebra. F. L. Neugebauer is entitled to the greatest credit for his thorough investigations, and many monographs have placed the subject in a very clear light.

The essential feature of this pelvis is a sliding of the body of the last lumbar vertebra over the first sacral and into the pelvis, carrying, of course, the spinal

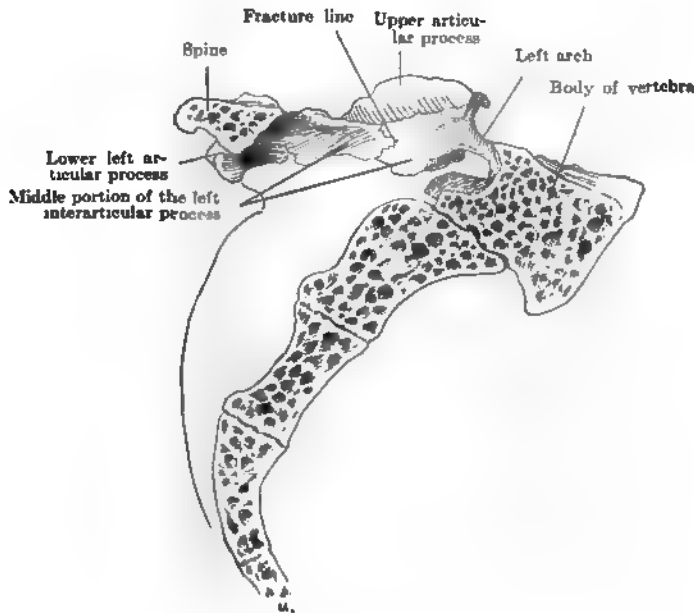


FIG. 620.—DETAIL OF SPONDYLOLISTHETIC SACRUM (Breus and Koliako).  
From the "large Vienna pelvis."

column with it. The articular processes of the vertebra and sacrum are not dislocated, the slipping of the body of the former being permitted by a stretching or fracture of the interarticular processes. The interarticular portion, instead of running vertically and being one-fourth inch long, runs horizontally and may be an inch or more long. The last lumbar vertebra thus comes to be much elongated from before backward, and may even be bent over the sacrum like a clamp.

The apposed portions of the two bones are compressed and often synostotic, with the formation of an exostosis. Severe injury is probably seldom the cause of this peculiar deformity—more likely Neugebauer's explanation applies. There is a congenital lack of fusion of the ossification areas of the anterior and posterior ossification centers of the lateral portions of the vertebra, a spondylolysis interarticularis, which finding is not rare in skeletons. This weak spot is made up of cartilage, is a pseudarthrosis, or is held together by fibrous bands, and, under exterior agencies, injury, or carrying heavy loads, gradually yields to the pressure of the trunk, allowing the anterior portion of the vertebra, especially the body,

to warp over the sacrum into the pelvis. The deformity has been observed in coal-heavers, but probably here, too, some congenital deformity of the bones existed or it should be more common.

On the pelvis, spondylolisthesis has a very deforming action: (1) the inclination of the pelvis is obliterated, in marked cases the inlet being almost horizontal; this is due to the attempt of the woman to keep her balance by tilting the trunk back, and thus overcome the tendency to fall forward; (2) the lumbar spine projects over and into the inlet,—pelvis obtecta,—in a way not unlike that of lumbosacral kyphosis, and the promontory becomes the fourth

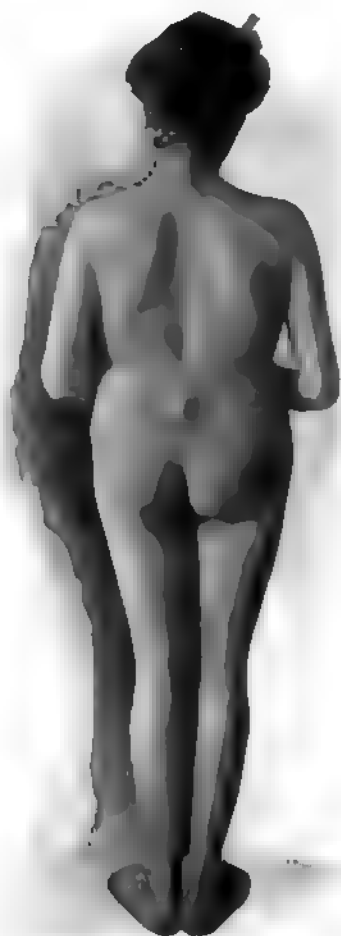


FIG. 621.—SPONDYLOLISTHETIC PELVIS.  
Shows the hump of last lumbar spine.



FIG. 622.—SPONDYLOLISTHETIC PELVIS.  
Shows pubis rotated upward.

or even the second lumbar vertebra; (3) the available true conjugate of the pelvis may be reduced to even 5 cm.; (4) the sacrum is rotated on a transverse manner similar to that of the kyphotic pelvis, and the lower tip tends to project forward; (5) the pubis, forming a funnel-shaped canal; (6) the innominate bones, rotated to the rotation of the sacrum and the tug of the muscles and iliofemoral ligaments converge toward the outlet, exaggerating the outlet contraction; (7) the distance between the posterosuperior iliac spines is increased; (8) the arcus pubis is bowed; (9) the pelvic joints are sometimes loose.

*Diagnosis.*—To the 123 cases collected by Williams I can add one (



1. Breus and Kolisko could find only 20 anatomically proved specimens of deformity.

study of the accompanying photographs will disclose the main points on which diagnosis may be based, and internal examination will almost always render the diagnosis positive. This patient gave a history of a severe fall in childhood, followed by a long confinement to bed. The following features are to be noted: (1) short stature, but the arms, legs, and chest are of normal size; (2) the pelvis rotated upward (indicated by the course of the lines which have been painted on the iliac crests), and the ribs nearly rest on the iliac bones; (3) the vulva is

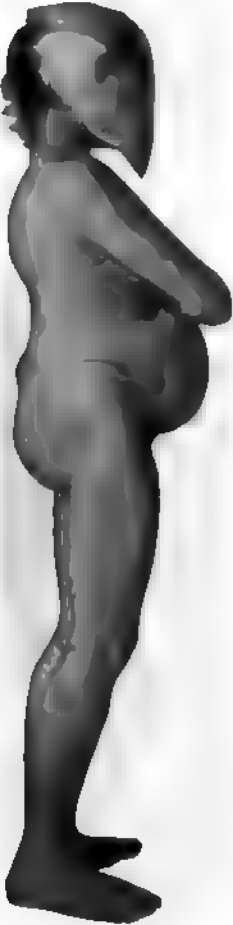


FIG. 623.—SPONDYLOLISTHETIC PELVIS (SIDE VIEW).  
Position of last lumbar and horizontal crest of ilium.

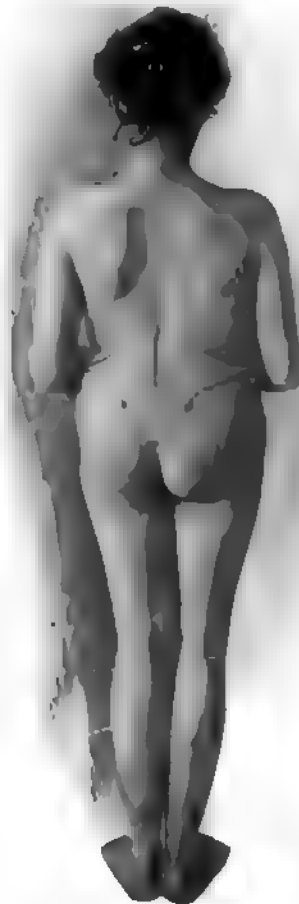


FIG. 624.—SPONDYLOLISTHETIC PELVIS.  
Ribs almost rest on crests of ilia. Upward curve of crests is shown by lines drawn on the skin.

upward and looks forward; (4) the posterosuperior spines are far apart, the umbiloid of Michaëlis is broad, runs vertically, and the spines are prominent, especially the last lumbar, which stands out sharply, as is seen in Fig. 623. The compensatory lordosis is well shown, and the head too is thrown back. The patient was allowed to walk on a long strip of paper, her feet having been marked with rubber-stamp ink, and Fig. 625 reproduces her footprints. They show the short steps and the narrow tread (tight-rope walker's gait), corresponding with Neugebauer's ichnographic tracings very closely.

At the internal examination the overhanging lumbar spine could be easily

outlined, but it was not so marked as in most of the specimens published. sacrum, with its lateral wings, could be easily distinguished from the last lu

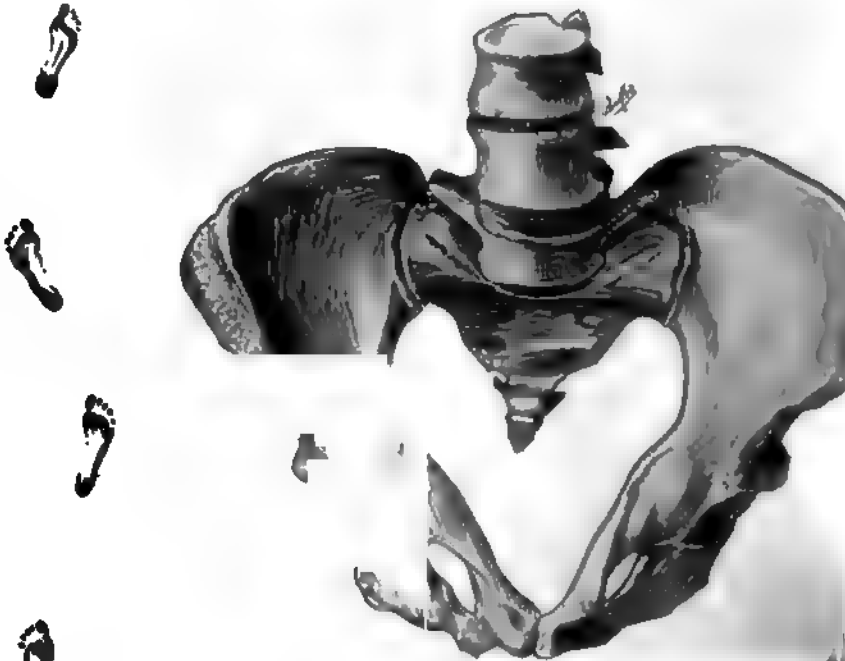


FIG. 626.—OSTEOMALACIC PELVIS. MILD DEGREE (Chicago Lying-in Hospital)

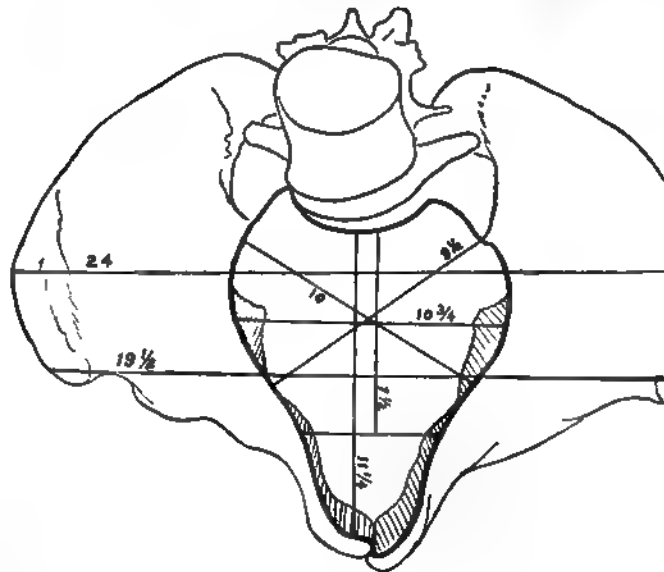


FIG. 627.—MEASUREMENTS OF FIG. 626. OSTEOMALACIC PELVIC INLET

FIG. 625.—TREAD OF SPONDYLOLISTHETIC PATIENT. "TIGHT-ROPE WALKER'S TREAD."

Patient's feet were painted with red ink and she walked on a strip of wall-paper, which was then photographed.

vertebra, the sharp angle could easily be felt, and there was nothing at either side of the body of this vertebra—the bifurcation of the common iliac artery was distinctly palpable on the left side, but not on the right. Von Winckel proved that this last finding was unreliable, being found also in kyphotic pelvises.

**The Osteomalacic Pelvis.**—Part of the general affection, osteomalacia, which has already been considered (p. 520), is the deformity of the pelvis, and, from the obstetrician's point of view, the most important. As the result of the action of the trunk pressure, the pressure of the heads of the femora, the traction of the muscles and ligaments on the softened bones, the pelvis is crowded together in an astonishing manner. Figs. 626 to 629 show these deformations, and description is unnecessary. The sinking downward and forward of the sacrum, the beak-like distortion of the horizontal pubic rami (due to the inward pressure of the femora), the approach of the tuberosities of the ischia, the rolling inward of the iliac crests, must be emphasized. On the pelvic lumen this invasion from three sides and above produces very decided effects—indeed, the cavity may be almost obliterated.

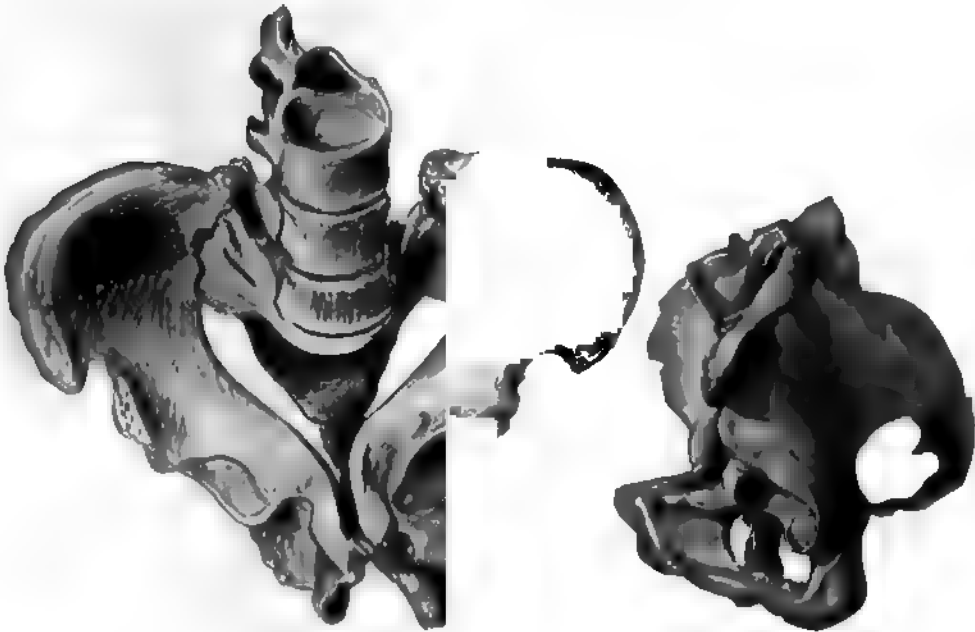


FIG. 628.—OSTEOMALACIC PELVIS. HIGHEST DEGREE.

FIG. 629.—LEFT VIEW OF FIG. 628.

Labor is rendered impossible if the process is at all advanced, but if it occurs when the osteomalacia is in the florid stage, the soft bones may give way to the head advancing under the influence of strong pains, and dilate enough to allow the child to pass through. This dilatation of the pelvic canal has been found in 17 to 30 per cent. of the cases, but in practice it is best not to depend on it.

**Diagnosis.**—From the history of the patient one will learn that the body has gradually grown shorter, with complaint of rheumatoid pains in the back and the pelvis, difficult and painful locomotion (duck-gait), contraction of the adductor thigh muscles, muscular trembling, paresis, asthenia, and progressive invalidism. Previous labors have grown successively more difficult. Tenderness is found over most of the bones, and the incurvations of the spine, the ribs, and the extremities are usually present in sufficient degree to be found. On the pelvis the most decided changes are discoverable, the most notable being the beaked pubis, the narrow pubic arch, which in the author's case hardly permitted two fingers to pass; the sharply curved sacrum and low promontory. All the external measurements are diminished.

In the differential diagnosis the pseudo-osteomalacic rachitic pelvis need be mentioned, but the history, the disease appearing in childhood, will at once eliminate this. Spondylolisthesis is also easily determined.

### DOUBLE DISLOCATION OF THE HIPS

Congenital dislocation of the hips is not a very rare deformity, and only recently have the efforts of the orthopedists been successful in correcting it. When such

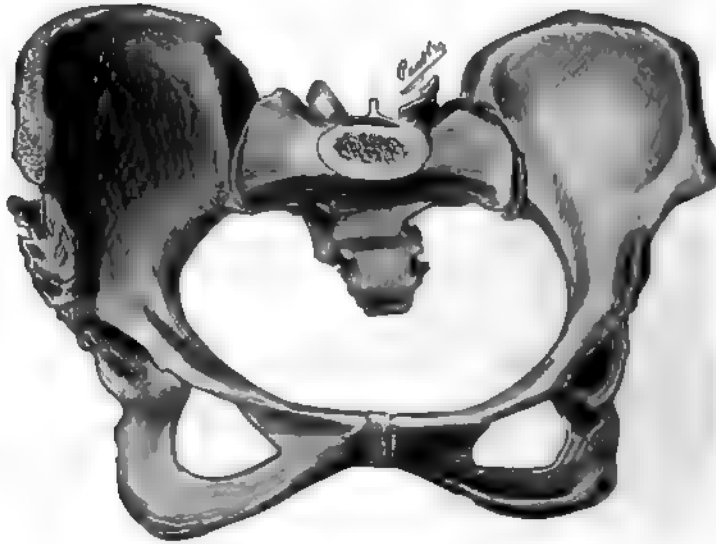


FIG. 630.—DOUBLE DISLOCATION OF HIPS.



FIG. 631.—RIGHT ELEVATION OF PELVIS. DOUBLE DISLOCATION OF HIPS.  
Shows new acetabulum.



FIG. 632.—LEFT ELEVATION OF PELVIS. DOUBLE DISLOCATION OF HIPS.  
Shows contracted acetabulum and new acetabulum.

a child begins to walk, the trunk pressure forces the whole pelvis onto the iliofemoral and capsular ligaments, the line of gravity is anteposed, the spinal column is thrown

back to preserve the balance, the result of all this being a forward tilting of the pelvic girdle and increase of pelvic inclination. Since the transverse pressure exerted by the heads of the femora fails, distinct flattening of the pelvis results (Fig. 630). The outlet is very large.

**Diagnosis.**—In the accompanying photographs the characteristic appearance of such a woman is to be seen. The high trochanters, the broad hips, the lordosis with increased pelvic inclination, the folding of the skin at the hips, the loose-

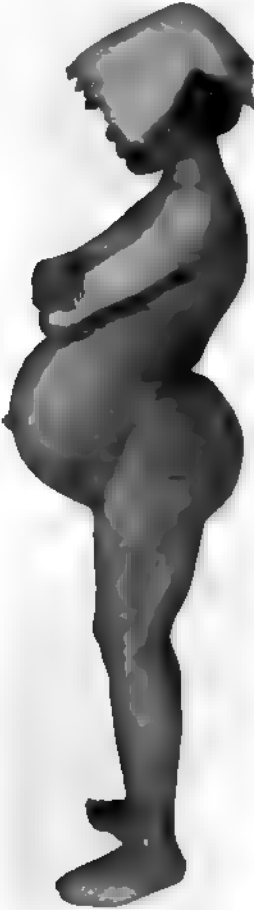


FIG. 633.—DOUBLE DISLOCATION OF HIPS.

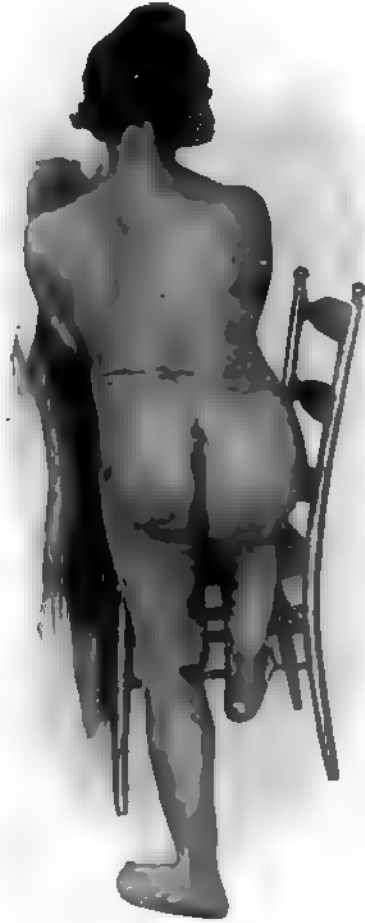


FIG. 634.—DOUBLE DISLOCATION OF HIPS.  
Shows downward and backward rotation of head of femur when leg is flexed.

jointed gait—all strike the eye at once. On internal examination the shortening, if there is any, of the conjugata vera is easily determinable. Labor has the characteristics of that in flat pelvis.

For the sake of completion may be mentioned the pelvis split at the pubis, an accompaniment of ectopic bladder,—gastroschisis,—and the case of absence of the sacrum, both scientific curiosities.

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*Brues and Kahato:* Die pathologische Beckenformen, 1902 to 1912.—*Klien:* Volkmann's Samml. klin. Vort., N F., No. 169, 1896.—*Williams:* Amer. Jour. Obstet., July, 1911.—"The Rhomboid of Michaelis," *L'Obstetrique*, January, 1910, p. 65.—"Spondylolisthesis," *Arch. f. Gyn.*, vol. lii, p. 101.

## CHAPTER LV

### CLINICAL ASPECTS OF CONTRACTED PELVES

**During Pregnancy.**—Certain varieties of contracted pelvis may interfere with coitus, for example, the double coxalgic, with ankylosis. Very large pelves allow the uterus to sag down onto the pelvic diaphragm, and such women show increased pelvic floor projection. It has seemed to me that they suffer larger tears in labor and are liable to develop prolapsus uteri. Retroversion of the uterus may be maintained by an overhanging promontory, and if pregnancy supervenes, an operation may be needed to restore the uterus to its place.

As a rule, it is later in pregnancy that the effects of pelvic obstruction become apparent. Since there is no room in the pelvis for the growing uterus, it forces itself upward, the abdomen is overdistended, the anterior wall stretches, or the recti part and the fundus uteri falls forward, the condition being known as pendulous abdomen (Fig. 353, p. 413).

If the muscles retain their integrity, the uterus is forced upward against the ribs and forms here a high plateau. Another effect of contracted pelvis is the conferring of a great degree of mobility on the uterus. The organ, since its pelvic attachments are overstretched and it lacks the support of the side walls of the pelvis, is free to sag from side to side with every turn of the patient. Some women complain much of this, and require the support of a firm binder. From the same causes the position and presentation of the fetus change readily and frequently. The cephalic pole does not remain so constantly over the inlet, hence when labor begins quite often the child is found in an unfavorable attitude and presentation, which, becoming confirmed by the uterine contractions, causes serious dystocia. Varicose veins of the vulva and limbs, especially if one or more severe operative deliveries have preceded, are often particularly marked. Occasionally, in primiparae, the head enters a contracted pelvis in the later weeks of pregnancy, and labor is unexpectedly easy. The head, by its configuration, may show the shape of the pelvic cavity. Subsequent labors may be difficult.

**During Labor.**—*General Considerations.*—Labor is likely to be a little premature in contracted pelves of the flat variety, and to be prolonged in those of the generally contracted, funnel, and masculine types. Reasons for this I cannot advance, but such has been my experience. When labor has frankly declared itself in a woman with contracted pelvis and at term, it early becomes evident that the process is not going as it should, and the observant accoucheur soon perceives that it is not alone the spacial disproportion which causes dystocia, but many other factors—abnormal presentations, positions, attitude, the size and hardness of the fetal head, irregular uterine action, premature rupture of the bag of waters, etc.

Abnormal presentations—breech, face, brow, shoulder—are four times as frequent with contracted pelvis. Litzmann having found the cephalic pole presenting normally in only 84 per cent. of his cases (usually in 96 per cent.). The reason for this is that the head, finding the entrance into the superior strait blocked, glides off into one iliac fossa, producing an obliquity of the fetal axis to that of the inlet. It is now easy for a partial or even a complete rotation of the fetal ovoid to occur, and the pains coming on, the child is locked in its unfavorable position. Prolapse of the arm, foot, and cord are also much more common in all forms of pelvic contraction, but particularly in the flat varieties. The reason for

his is that the head does not lie firmly in apposition on the lower uterine segment, but is held away by the jutting promontory of the sacrum, which leaves unfilled spaces at the sides, through which the small parts easily slip. All these accidents are commoner in multiparæ with their flaccid and flabby uteri.

A great deal depends on the size and moldability of the fetal head and of the trunk. If the bones are soft, they easily give themselves to the shape of the inlet, and apparently great disproportion may thus be overcome. If the child is small, the pelvis, relatively, may not be at all contracted, while if the infant is large, the contraction of the pelvis must be rated higher.

Of prime significance in all labors with contracted pelvis is the action of the uterus. Speaking broadly, the strength of the uterus is proportionate to the amount of work required of it. In some cases the uterus acts regularly and with increasing power as it finds that the child does not progress through the birth-canal. Within well-defined limits this augmented action of the uterus is healthy and very desirable, because by this means nature often overcomes spacial disproportion between the head and the pelvis which no one would have thought possible. The recurring pains adjust, compress, mold, and propel the head through the narrowed canal in a fashion that the finest art absolutely fails to imitate. Further, good pains dilate the cervix and prepare the soft parts for the passage of the fetus. Weak pains are a most unwelcome complication of labor in contracted pelvis. They may be primary or secondary. Primarily weak pains frequently accompany generally contracted pelvis and are another expression of the infantilism which caused it. Again, other causes of weak pains may exist. Weak pains from exhaustion, tetanus, or infection of the uterus are much more significant and correspondingly serious. To weak uterine action are often added weak abdominal muscles, so common with pendulous belly, a frequent complication of contracted pelvis. If the passage is not too markedly contracted and the child is of moderate size; if the presentation and position are good and the pains strong, the large majority of labors will terminate spontaneously and happily for both mother and child. Even experienced accoucheurs will often be surprised to see what nature can accomplish properly supported and not interfered with. On the other hand, the contraction of the pelvis may be negligible, as far as spacial disproportion is concerned, but it has caused an abnormal presentation—for example, brow or shoulder, which results in perhaps fatal dystocia.

*The First Stage.*—At the beginning of labor the head is high up, not engaged, as so often happens in healthy primiparæ and in multiparæ with strong abdominal walls. It does not even project into the pelvis with a large segment, but floats high, almost out of reach of the finger. It does not fit the lower uterine segment accurately, hence the membranes over the os are exposed to the full force of the uterine contraction. If they are delicate, they burst and the liquor amnii drains away; if they are tough, they are stripped off the lower uterine segment and pouch down into the vagina or even to the vulva, stocking shaped, and are of little service as a fluid dilating wedge. The evil consequences of early rupture of the sac are: (1) loss of the hydrostatic cervical dilator; (2) increased danger of pressure necrosis of soft parts lying between head and pelvis; (3) increased possibilities of prolapse of cord, arm, and feet; (4) infection may gain entrance to uterine cavity and cause chrysometra, fetal death, and sepsis. If the membranes rupture before complete dilatation has been secured, the lower uterine segment and cervix collapse, and it requires prolonged effort on the part of the uterus to open the passage again. Von Lerff's experience must have been contrary to that of most observers, for he finds that rupture of the bag of waters in contracted pelvis is not an event to be feared; that the dilatation progresses just as satisfactorily as before, or often better.

True, the pains may be stronger after the waters have drained away, but experienced accoucheurs will find it hard to admit that the head makes as efficient

the superior strait. That parietal bone which first meets with resistance is pressed under the other, and the plate of the occipital bone lies under the two parietals. The overlapping may be so marked that the dura mater begins to strip off, and a row of minute hemorrhages will be found on either side of the longitudinal sinus. Fig. 635 shows the head of a child spontaneously delivered after four days' labor. This length of time is very seldom required for the process; indeed, nowadays such cases are not allowed to take so long, but interference is thought necessary after giving the natural powers reasonable opportunity to show how much they can accomplish. From four to ten hours of good strong pains will almost always suffice for the test, but even here great watchfulness is indicated lest mother or babe suffer harm from the experiment.

As soon as the head has been molded so that it is ready to pass through the inlet the pains assume an expulsive character—the parturient bears down, the head drops into the excavation, and the occiput begins to rotate to the front.

Three signs indicate that the head is descending: (1) The patient begins to bear down; (2) feces are discharged, or the woman expresses a desire to go to stool; (3) cramps of the muscles of the legs occur—usually the left leg in left occiput positions and vice versa. The first two symptoms are due to the pressure of the head upon the rectum; the last one, to irritation of the sacral plexus by contact of the advancing head. In flat pelvis, in which the resistance is met only at the inlet, this part of the labor is completed with surprising quickness. In multiparæ one or two powerful expulsive pains procure anterior rotation and the birth of the head; in primiparæ the soft parts have to be overcome, and this requires the usual time. The head may be given a shape different from that acquired in the passage of the inlet by the molding caused by the pelvic floor. If the pelvis is generally contracted, the resistance continues all the way to the outlet, and labor is unduly prolonged and tedious. In addition the uterine action in this class of pelvis is often weak, the uterus partaking of the general hypoplasia. Women with funnel and masculine pelvis are also prone to uterine inertia. Occipitoposterior positions, imperfect dilatation of the cervix, and strictura uteri (hour-glass contraction) are also more common in them.

After the head is delivered the main difficulty is overcome, but if the child has broad shoulders, they may cause much trouble, especially in the generally and transversely contracted pelvis. Many an infant has been lost during the prolonged attempts to deliver impacted shoulders. At any point the uterus may give out and labor comes to a standstill, requiring the assistance of art. It is as often the nervous system of the woman or the condition of the baby which demands interference as the uterus proving default.

The third stage does not present any conditions which are peculiar. Post-partum hemorrhage is rare if the pains have been good, but if the delivery has been operative, lacerations and bleeding must be expected.



## CHAPTER LVI

### MECHANISM OF LABOR IN FLAT PELTS

AN experienced accoucheur can diagnose the nature of the pelvis by observing the mechanism with which the head passes through it. Many of its motions are characteristic of flat and of generally contracted types. In flat pelvis abnormalities of position and presentation are very common. Owing to the jutting forward of the promontory, the head cannot enter the pelvis and, therefore, slips off to one side, which often allows the cord to prolapse in the free space thus provided. The



FIG. 636.—ANTERIOR PARIETAL BONE PRESENTATION. HEAD MOLDING ITS WAY INTO FLAT PELVIS (adapted from Smellie).  
Dotted line shows caput succedaneum.

head tries to enter the pelvis flexed, as in the usual mechanism of labor, but the biparietal diameter is too large to pass through the conjugata vera, the diameter of greatest contraction. As a result the head slides off to the side, the bitemporal, a smaller diameter, comes to lie in the conjugata vera, while the biparietal lies in the larger space opposite the sacro-iliac joint. As soon as the head sinks the forehead descends, because the resistance offered the occiput is greater—deflexion, instead of flexion, the first movement, occurs. Owing to the long transverse and short sagittal diameters of the inlet the head seeks the position which will easiest allow it to advance—that is, the sagittal diameter of the head will lie in the transverse of the pelvis. Since the jutting promontory forces the head forward the avail-

able—or obstetric—transverse diameter of the inlet lies anterior to the true or anatomic transversa. The available space, therefore, for the passage of the head is much reduced, the pelvis, though large, going into the class of justominors.

A third and most important abnormality of the mechanism is the almost constant lateroflexion of the head, that is, the parietal bone is inclined on one or the other shoulder, or, in other words, the head enters the pelvis in exaggerated asymclitism. This is called parietal bone presentation. Normally, although some authorities deny it, the head often enters the pelvis with slight anterior asymclitism, that is, obliquity of Naegelè. In flat contracted pelvis this is exaggerated, and sometimes the lateroflexion is so great that the anterior ear is palpable behind the pubis—ear presentation. In the subsequent course of labor the posterior parietal bone rolls over the promontory into the pelvis, the anterior bone forming a sort



FIG. 637.—NEXT STAGE OF THE MOLDING. POSTERIOR PARIETAL ROLLS OVER THE PROMONTORY. HEAD NOW DAMAGED.  
Sagittal suture comes near middle line.

of sliding fulcrum on the posterior wall of the pubis. The amount of molding of the cranial bones needed to allow the descent of the head according to this mechanism depends on the size and hardness of the head and the roominess of the inlet, and the time required depends also on these factors plus the strength of the uterine contractions. The process may be completed in a few hours, or may last over a day (Figs. 636, 637, and 638). That part of the head which rubs over the promontory often shows a pressure mark—a red streak. In right positions the red mark (in bad cases, real pressure necrosis) lies over the right parietal bone, parallel with the coronary suture; in left positions, in a corresponding location over the left parietal bone. The configuration of the head is sometimes remarkable. In one of the author's cases the head, viewed from above, had the shape of a kidney, and was almost a mold of the pelvic inlet. If the head remains long in the pelvis after

which the shoulder makes with the head just above the pubis, and often the right parietal bone can be felt here—in one case the ear was indistinctly outlined

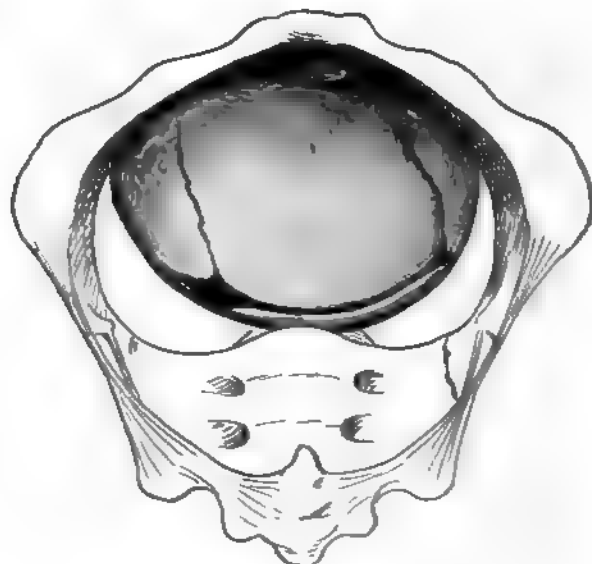


FIG. 639.—TOUCH PICTURE. ANTERIOR PARIETAL BONE PRESENTATION. NARROWER'S OBLIQUITY. Sagittal suture near sacrum, ear near pubis. This picture also shows how the jutting promontory crowds the forward, rendering useless a large part of the area of the inlet, the rear part of pelvis being empty.



FIG. 640.—POSTERIOR PARIETAL BONE PRESENTATION. FLAT PELVIS. Dotted line is caput succedaneum.



FIG. 642.—HEAD ENTERING A GENERALLY CONTRACTED PELVIS. FLEXION MARKED.

because of the inevitable injuries to the soft parts and the great compression of the child's brain. If the delivery is spontaneous, laceration of the perineum seldom occurs, because the head is so long drawn out.

The diagnosis of labor with generally contracted pelvis is usually easy. Abdominally, the extreme flexion is indicated by the high forehead, easily palpable over one ramus pubis, and the deep occiput, usually not palpable, even when the hand is pressed deeply into the groin. Vaginally, the small fontanel lying almost in the axis of the pelvis and the vertical position of the sagittal suture disclose the extreme flexion so characteristic of this form of labor.

Labor in pelves, both generally contracted and flat, partakes more of the nature of the mechanism of flat pelvis. Most authors say that labor partakes of the characteristics of both forms—combined in degrees varying with the preponderance of either deformity, but in my experience the head never could get into the pelvis far enough to meet the resistance all around and thus exaggerate the flexion. High transverse arrest is the condition

Pressure marks are unusual because the resistances met are broad, not sharp, as in flat pelvis, and when they are present, owing to the flexion of the head, are found on the frontal bone, which lay against the promontory. Excessive length of the occipitofrontal diameter characterizes the molding in these cases, the occiput is peaked, the forehead and face are flattened, the neck is almost in a line with the back of the head, and the chin is buried in the chest. Lateral asymmetry is also marked. Extreme overlapping of the bones and minute cracks and fissures of the parietals or frontals are very common.

Labor in this form of pelvis is usually very slow and tedious. The uterus, partaking of the general hypoplasia, acts poorly, and often gives out before the head has passed all the narrow straits, instrumental interference being required. This is especially dangerous to both mother and babe



FIG. 643.—HEAD ENGAGED IN GENERALLY CONTRACTED PELVIS. ROTATION COMPLETED.

usually found, and, even in moderate degrees of contraction, cesarean section or, on the dead or dying child, craniotomy is often necessary. Not seldom the accoucheur, finding he has to deal with a flat pelvis, meets unexpected difficulty, and investigation will show that moderate lateral contraction exists in addition. Since such contraction of the sides of the inlet leaves no place for the head, compressed in the *ajugata vera*, to expand in, these difficulties are easily explained, and generally contracted flat pelves present the most formidable complications unless early recognized.

### MECHANISM OF LABOR IN FUNNEL Pelves

At the pelvic outlet the resistance begins, and the head comes to a stop at this point. Now extreme flexion occurs, and the labor resembles that of generally contracted pelves. If the funnel shape of the pelvis is due to kyphosis, as an additional complication the spinal column may overlie the inlet (pelvis obiecta) and prevent entrance of the head into the superior strait. If spondylolisthesis exists, the same obstruction may present, and then labor is usually impossible without cesarean section. Klien emphasizes the frequency of occipitoposterior positions and forehead presentations. Such malpositions are probably due to the pendulous uterus, the small back fitting best to the posterior uterine convexity and its belly being bent over the pubis.

Pelves contracted transversely at the outlet are not so rare as was formerly thought. Klien has shown their immense clinical importance. Since the contraction lies between the descending rami of the pubis and the tuberosities of the ischia, the broad occiput cannot use this space during its passage under the symphysis, but is forced backward onto the perineum and against the sacrum and coccyx (figs. 644, 645, and 646). As a result the perineum and levator ani are often torn, the coccyx broken, and if the sacrum curves too far forward, labor becomes impossible. The author is convinced that a large number of forceps cases with deep pelvic floor injuries and tearing of the vagina over the spines of the ischia, often to the walls of the pelvis, come in this class but are unrecognized.

The diagnosis of labor in funnel pelves will vary with the engagement or non-engagement of the head. When the head reaches the pelvic floor it is arrested, packed between the ischia, but usually anterior rotation of the occiput has been completed. Strong bearing-down efforts produce no advance, *the perineum is not stretched on the stretch*, bulging does not occur, and the parturient, soon perceiving that further bearing-down efforts produce no real effect, gives up trying and calls for relief. Internal examination will disclose the head in exaggerated flexion, lying closely packed between the spines of the ischia and covered with a large caput succedaneum. Rotation is usually complete, but sometimes the sagittal suture lies in the transverse diameter—that is, “deep transverse arrest” has occurred. If the measurements of the pelvis have been taken in the routine pregnancy examination, such a course of labor will bring no surprise. In determining whether the head will or will not pass the outlet the accoucheur must know two distances—first, that between the tuberosities of the ischia, and, second, that from the center of this diameter to the tip of the sacrum—the “posterior sagittal” of Klien.

Klien says a normal outlet has a transverse diameter of 11 cm., an anterior sagittal of 6 cm., a posterior sagittal of 9.95 cm., but my own measurements are a little smaller, in which Williams agrees.

The determination of the bi-ischiatic diameter is made as shown in Fig. 273 (p. 248), and is more easily measured in labor than at any other time. By holding a short rod in this diameter and applying one end of the pelvimeter to its center and the other over the end of the sacrum, the posterior sagittal is obtained. One centimeter must be deducted for the thickness of the bone and soft parts. Several special pelvimeters are on the market (Klien's, Thom's), but this method is satis-

factory. One may also obtain the posterior sagittal diameter by geometric method, since the hypotenuse and the base of the two outlet triangles can be measured.

It is apparent that, even if the narrow pubic arch forces the head back against



FIG. 644.—HEAD ARRESTED AT OUTLET BY CONTRACTION.  
Note how head stems against descending ramus of pubis and is thrown against coccyx.

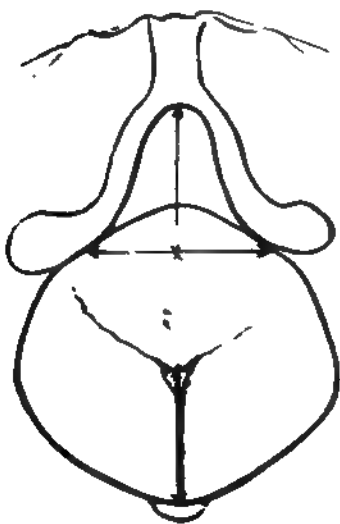


FIG. 645.—HEAD ARRESTED AT OUTLET BY CONTRACTION.  
Note how head stems against descending ramus of pubis and is thrown against coccyx.

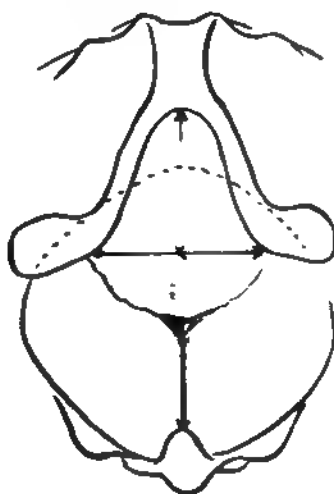


FIG. 646.—ARRESTED IMPROPERLY. HEAD  
TILTED BY NARROW OUTLET. Note how  
head stems against coccyx and is thrown  
against descending ramus of pubis.

the narrow arch and section of the latter does not curve forward too much, there will still be a considerable amount of the resistance of the hyperextended head—only the soft parts will give way. If the anteroposterior diameter is less than 9 cm., it is the

rule to experience trouble with the delivery and forceps are often needed. If, in addition, the posterior sagittal (Fig. 646) is less than 9 cm., labor is very difficult or even impossible, and craniotomy is usually finally resorted to. Williams and Klien seem agreed that a pelvis with a diameter of less than 7.5 cm. between the tuberosities and a posterior sagittal less than 8 cm. offers insuperable obstruction to labor and demands cesarean section, pubiotomy, or craniotomy.

Breech labors are especially bad in funnel and transversely contracted pelves, because the head has no time to mold, and forceps on the after-coming head are very often required. Even then many babies are lost. If the patient is a very old primipara, and if it seems likely that the present will be the only pregnancy, the high infantile mortality and the severe pelvic injuries which are inevitable with forceps delivery should be given great weight when deciding for or against cesarean section. Forced operative delivery in such cases often results in deep lacerations of the vagina, pelvic floor, and rectum, even rupture of the pubis, and shows a painfully high infant mortality.

#### LABOR IN OBLIQUELY CONTRACTED PELVIS

Everything depends on the amount of contraction of the conjugata vera, and, of course, on the forward protrusion of the promontory. If the promontory projects low toward one iliopubic tubercle, it will eliminate that half of the pelvis, as far as using it for the passage of the head is concerned (Figs. 647 and 648). This

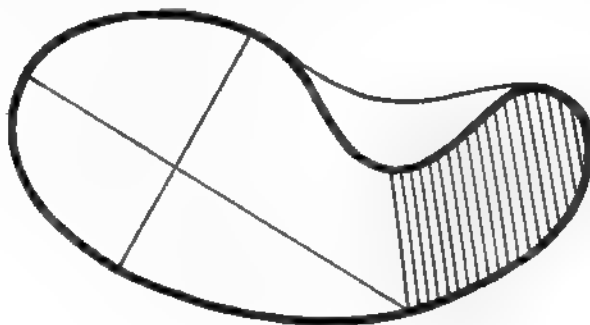


Fig. 647.

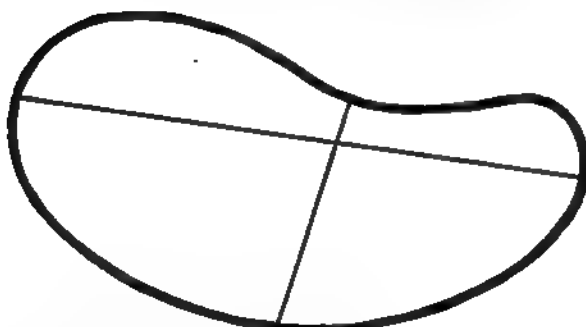


Fig. 648.

FIGS. 647 AND 648.—DIAGRAMS SHOWING HOW, WHEN THE PROMONTORY JUTS INTO THE PELVIS ON ONE SIDE, THAT SIDE IS RENDERED USELESS FOR THE ENTRY OF HEAD, AND CHANGES THE INLET TO ONE OF THE HIGHLY CONTRACTED TYPE. SHADED PORTION IS USELESS FOR LABOR.

is equivalent to a generally contracted pelvis of highest degree. A very sharp clinical distinction must be made between pelves which are simply distorted, but with little or no reduction in the area of the inlet and those which are actually contracted or

are so much distorted that actual contraction results. Generally it is best for the occiput to come down in the large half of the pelvis (Figs. 648 and 649), but sometimes it is best for it to enter pointing toward the contracted half. Then the biparietal diameter will lie in promonto-iliopubic diameter, and the forehead come down over the opposite sacro-iliac joint. In Naegelè pelves the labor is further complicated by the reduction in size of the passage all the way to the outlet. In rachitic pelves this does not obtain, and, once the head passes the inlet, labor is quickly ended.

In several of the author's cases the occiput did not rotate to the front, but re-

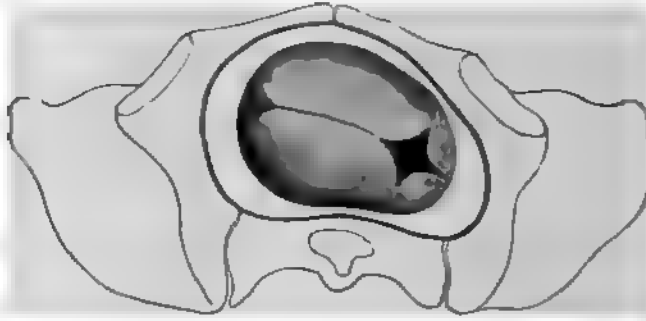


FIG. 649.—HEAD MOVING INTO AN OBLIQUELY DISTORTED PELVIS.  
Case from which the x-ray plate was made, Fig. 596.

mained in the oblique, and the head escaped over one or the other ramus pubis, the latter acting as the fulcrum against which the nape of the neck stemmed, while forehead and face appeared from behind the opposite ischial tuberosity. Breech labors are unwelcome in obliquely contracted pelves, and it is most desirable for the occiput to come down on the side *not* contracted. Such a mechanism should be brought about, if possible, during operative delivery.

#### LITERATURE

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## CHAPTER LVII

### PROGNOSIS OF LABOR IN CONTRACTED PELVES

**The Mother.**—Naturally, it is impossible to present figures of the mortality in labor in contracted pelvis, and the morbidity will always remain indeterminable. Mild degrees of pelvic contraction may not have much effect on the labor except the production of malpresentations, etc., which demand interference, and operative measures all carry a certain mortality and morbidity. In general, the prognosis of a given labor depends upon, first, the degree of pelvic contraction; second, the size and hardness of the child, especially of its head; third, the presentation, position, and attitude; fourth, the strength of the pains. If a complication, as hemiplegia or placenta prævia, is superadded, the prognosis is, of course, altered, and, finally, much depends on the cleanliness and skill of the attendants.

The mother is exposed to the following dangers: (1) Obstructed and impossible labor, which eventuates in—(a) Rupture of the uterus; (b) septicemia; (c) exhaustion and shock, with or without operation; (2) pressure necrosis of the walls of the genital tract; (3) injuries of the genital tract, for example, spontaneous rupture of the uterus, cervix, vagina, symphysis pubis, and traumatic rupture of the same; (4) infection in labor, with physometra (*tympania uteri*) or general septicemia; (5) exhaustion and shock.

If the labor is completely obstructed, the head wedges itself into the narrow pelvis and becomes firmly fixed (*paragomphosis*), the vagina and vulva become enormously swollen, suffused, and almost black, sometimes sloughing out entirely. In the less severe cases the constant pressure produces areas of necrosis which later make deforming scars or slough out, leaving fistulas,—rectovaginal, vesicovaginal, uterovaginal, etc.,—depending on the part of the pelvic viscera which underwent the severest compression between the head and the pelvis. Flat pelves have more fistulas than generally contracted, because in the latter the pressure is more evenly distributed. Pressure necrosis of the posterior cervical wall may cause adhesion of the peritoneum over the uterus and that covering the promontory, retrofixation of the uterus resulting. The fistulas are often not apparent for a few days, that is, it requires this time for the slough to separate and establish communication between the two cavities.

Injuries usually are the result of operative delivery, but sometimes the uterus itself, acting with terrific power, may force the child through its own walls, or through the unprepared cervix or perineum, or may even burst the pubic symphysis. Rarely the sacro-iliac joints are separated. Traumatic injury of the soft parts is due to too early and too forcible attempts at delivery, and even a skilful accoucheur may cause it when the tissues are softened and brittle from disease or long labor. The scars from these injuries may distort the pelvic viscera, causing malpositions of the uterus, chronic pelvic congestion, dislocation of the bladder; they may even open the sphincter vesicæ, causing incontinence, etc.

Infection in labor may come from without,—the usual way,—the physician carrying the bacteria either on undisinfected hands or transferring them from the vulva and vagina into sterile regions, and it may occur spontaneously, the result of the reduction of local and general immunity. Local immunity is destroyed in prolonged labor by the loss of the epithelium, its weakening by imbibition, by the alteration of the secretions of the parturient tract, the clear mucus being replaced by serum and blood, and, third, the local traumatism. The liquor amnii is very

prone to decomposition, and once the interior of the uterus is infected, the gazation is rapid. Tympania uteri is sometimes due to the *Bacillus aerogenes sulatus*, but more often to the *Bacterium coli commune*. General immunity weakened by the exhaustion and shock of the prolonged labor, anesthetic operations. Tetanus uteri is of grave omen. While it does not favor rupture of the uterus, labor comes to an absolute stop, and unless aid is rendered, mother and child are lost from exhaustion and sepsis.

Exhaustion and shock must not be forgotten as complications of prolonged labor, and too much given the patient to overcome. In women of gracile type, highly polished output of our finishing schools, with one or several generations of overcivilized ancestors, the shock of hard labor is badly borne, and the nervous system may suffer permanent damage. While contracted pelves are uncommon in this class (perhaps a tendency to general smallness may be noted), the children are usually well grown, and since the uterine action is nearly always deficient, operative interference is frequently required. It is important to watch the effect of labor on the nervous system and interfere before serious inroads have been made on it.

Breech and shoulder presentations, in some respects, are better for the mother than the head, because they do not cause pressure necrosis, and early attention is called to the anomalous pelvis. The passage of the child in delivery is rapid, and experience shows that intense compression of short duration is less dangerous to tissues than a mild pressure kept up for a long time.

**The Child.**—In the highest degrees of pelvic contraction the child has the best chances for its life, because the absolute disproportion is usually early recognized and cesarean section performed. In the very slight pelvic contractions the mortality is not much higher than usual, but anomalies of the mechanism of labor must be remembered. Many children still are lost in the cases where the pelvis is contracted enough to show in the course of labor, and this is because the accoucheur has not carefully studied his patient. Too many women are allowed to go into labor, and only after the good time for cesarean section or periotomy has gone by is the spacial disproportion discovered. Often it is found after the accoucheur has failed to deliver with forceps.

Asphyxia causes the largest number of fetal deaths, and it is brought about by—(1) Interference with the placental circulation, the result of the frequent powerful uterine contractions—the blood is forced out of the uterus by the pressure; (2) compression of the brain as the head is jammed through the inlet—the pressure irritates the pneumogastric, slows the pulse, and compromises still further the circulation of the fetal blood; (3) as the effect of the early rupture of the membranes and the escape of the liquor amnii the uterus retracts, the placental area is diminished and abruption of the organ is favored; (4) prolapse of the cord is common, especially in flat pelves, and this is always a very serious affair for the child. As long as the bag of waters is intact these dangers hardly exist, but it would be wrong to say they never threaten the child, because I have seen death of the fetus occur from the above mechanisms with an intact amniotic sac.

Injuries of the brain, of the cranium, and of the body of the child are very common. Many children die from cerebral compression without external injury, but not a few die from concussion of the brain from forceps or breech delivery. Often death is due to intracranial hemorrhage from skull fracture. This may take the form of fissures radiating from the center of ossification of the flat bones to the sutures of the skull. Many times cephalhematoma is due to such fissure, the clot in these instances being outside the skull, under the periosteum. Tears of the tentorium cerebelli also occur in difficult labors. Depressed skull fractures occur with forceps, but particularly with breech deliveries, and they look like a bone had been pressed in with a spoon (Fig. 650). They are sometimes attended by intracranial hemorrhage, and are then usually fatal. They are

are located between the parietal bosses and the coronary sutures, but one of my cases showed the depression right behind and above the left ear.

If not primarily fatal, the child may recover and show no signs of permanent damage to the brain, the deformity becoming less with time, but never disappearing. Another form of skull depression, not always a fracture, because the bone is soft and flexible, is the groove (Fig. 651). This deformity is due to the molding of the head by the sharp promontory, and disappears almost entirely in a few months. It is harmless of itself, but may be serious if large, deep, or complicated by fracture or intracranial hemorrhage. These flat depressions usually parallel the coronary suture. They require no treatment. Separation of the flat bones at the basilar sutures is one of the worst of the birth injuries, because the large cerebral blood-vessels lie in the neighborhood, and if torn, allow fatal intracranial hemorrhage.



FIG. 650.—SPOON-SHAPED DEPRESSION. EXTRACTION BY BRACH.

Three successive children had the same injury.



FIG. 651.—GROOVE DEPRESSION. FORCEPS CASE.

The parietal bone may tear away from the squamous portion of the temporal bone at the anterior lateral fontanel—the suture squamosa; the occipital plate may separate from the condyles. In the latter instance the plate then may be displaced directly onto the medulla, causing immediate death.

The morbidity of children delivered through contracted pelvises is also very large.

Pressure necrosis of the scalp has been already mentioned. This may be in all degrees from a simple desquamation with redness to actual sloughing of the tissues, with laying bare of the bone and exfoliation of sequestra—in a few instances followed by meningitis. These pressure marks are made by the promontory, but sometimes by an exostosis on the posterior surface of the pubis, and are the external evidence of long labor. Fistulas in the mother usually result at the same time.

Cephalhematoma is a complication of fractures of the skull. The clot lies under the external periosteum, is limited always by the sutures, may be single or multiple, external and internal combined, and may cover a depressed fracture. These hematomata alone are not fatal, but require many months for complete resorption, and leave a ridge of bone at the edges for many weeks more.

Caput succedaneum occurs in its greatest proportions in contracted pelves. It may be visible at the vulva while the head has not yet passed the inlet. Since the caput succedaneum is due to the fact that the pressure inside the uterus is greater than that in the vagina, it indicates strong uterine action. It does not show that the head fits the inlet tightly, and it does not do much to aid in the dilatation of the cervix, as some writers state.

In generally contracted pelves the caput, by lengthening the head wedge, may assist the labor, but little is thus accomplished. Of great clinical importance is the proper estimation of the caput, because if the scalp is visible at the vulva, the accoucheur may hastily conclude that the head is engaged and be misled into unfortunate operating, while in reality the head may be above the inlet. The caput also covers up the landmarks of the head and renders the diagnosis of position very difficult.

Fractures of the clavicle, the humerus, and the femur and disruption of the vertebral column are almost invariably due to brute force, exhibited during operative delivery. The same may be said of tearing of the nerves of the cervical plexus—Erb's paralysis, etc. Fracture of the long bones and of the skull may, however, occur during spontaneous labor.

The author is convinced that many children carry the effects of minor injuries received at birth all their lives. It stands to reason that the innumerable and thickly sown minute hemorrhages found in the brain after forceps and other hard deliveries must leave at least a fibrosis behind. These thickenings may explain cases of epilepsy, idiocy, paralyses, pareses, chronic headache, tic douloureux, retinal lesions, strabismus, and some other focal nerve diseases in later life. Even abnormal moral and mental conditions might be explained as due to injuries sustained at birth, though at present there is little evidence to support the theory. Such a belief would increase the burden of responsibility, already too heavily laid, on the shoulders of the accoucheur.

The outlook for the child depends, of course, on the degree of pelvic contraction, the severity of the operative delivery, the skill of the accoucheur, and the nature of the operation.

## CHAPTER LVIII

### TREATMENT OF LABOR IN CONTRACTED PELVIS

No subject in medicine presents greater difficulties in all its aspects than this one, and none demands so much art or practical skill. Science aids comparatively little here. Knowledge of the passages, of the powers, of the passengers, of the mechanism of labor, all help a great deal, but more depends on experience and judgment. Even large experience is fallacious and judgment is difficult—the words of Hippocrates, the truth of which is often proved when the accoucheur finds that a fetus he said could not pass through a certain pelvis is delivered before he can reach the bedside, and another which he confidently predicted would be born easily requires a grave operation. Many factors besides the pelvic contraction enter into the course of the labor, and success in treatment depends on the proper valuation of each and the proper placement of their relations to each other. Some of these factors can be accurately evaluated before or during labor, others partly, and a few not at all. These factors are the attitude, presentation, and position of the child, the size and hardness of its head, the shape of its body, whether there are one or two fetuses, the shape of the pelvis, that is, the distribution of the available space, the height of the promontory, the inclination of the inlet, the movability of the pelvic synchondroses, the state of the soft parts, the character of the uterine contractions (strong pains being able to accomplish wonderful results), the presence or absence of infection in the parturient canal, the nervous temperament of the parturient, and her general health. Outside factors must also often be considered: (1) The environment, whether the parturient is in a squalid tenement, in the country, in a home where every appliance is obtainable, or in a well-equipped maternity; (2) whether in the hands of the general practitioner or a trained specialist; (3) if the patient is a Catholic, all medically indicated procedures not being permitted; (4) the age of the parturient and the probability of her having more children. Even with this enumeration, the possible factors which might influence a labor or our decision regarding the course to pursue have not all been mentioned. It must always be borne in mind that nature is able to overcome the difficulties of contracted pelvises in the majority of cases. Ludwig and Savor found that 75 per cent. of such cases terminate spontaneously when the conjugata vera is not less than 9.5 cm.; that 58 per cent. with a conjugata vera of 9 cm., 50 per cent. with one of 8.5 cm., and 25 per cent. with one of 8 cm., require no aid from art. A course of watchful expectancy was all that was needed in these labors.

**Diagnosis of Disproportion.**—In all cases the first thing to determine is the existence and degree of disproportion between the child and the pelvis; in other words, the question must be answered, will the child go through the pelvis? The routine measurement of the pelvis of every pregnant woman coming under his care will have directed the accoucheur's attention to the existence of obstruction in the birth canal. Ten days before labor another examination should be made because it is much easier to obtain the internal measurements at this time. (See p. 245.) Special attention is given the pelvic outlet. The history of previous labors is of great value, but it must be carefully sifted. A woman may have had severe dystocia, even craniotomy or cesarean section, and yet have a normal pelvis which would give no trouble in the present labor. It is possible, with moderate experience and thorough application of our present methods, to obtain a quite accurate knowledge of the actual size of the pelvic lumen.

Not so much may be said of the child. It is harder to form an opinion of its size, and still harder to estimate the ossification and configurability of its head. The intra-uterine length of the child is easily measured (p. 275). With the cephalometer the transverse or the oblique diameters of the head can be obtained, and by deducting  $2\frac{1}{2}$  or  $1\frac{1}{2}$  cm., the biparietal diameter is approximately estimated—at least, one gains a fairly accurate idea of the size of the head. By grasping the child from the outside and placing the fingers against the head *per vaginam*, one may balance its body between the two hands and guess its weight and size. If the accoucheur will make this little manœuvre a part of his routine in every labor, checking up his guesses by weighing the children after delivery, he will be surprised to find, after a few years, how accurately he can estimate their weight. One de-

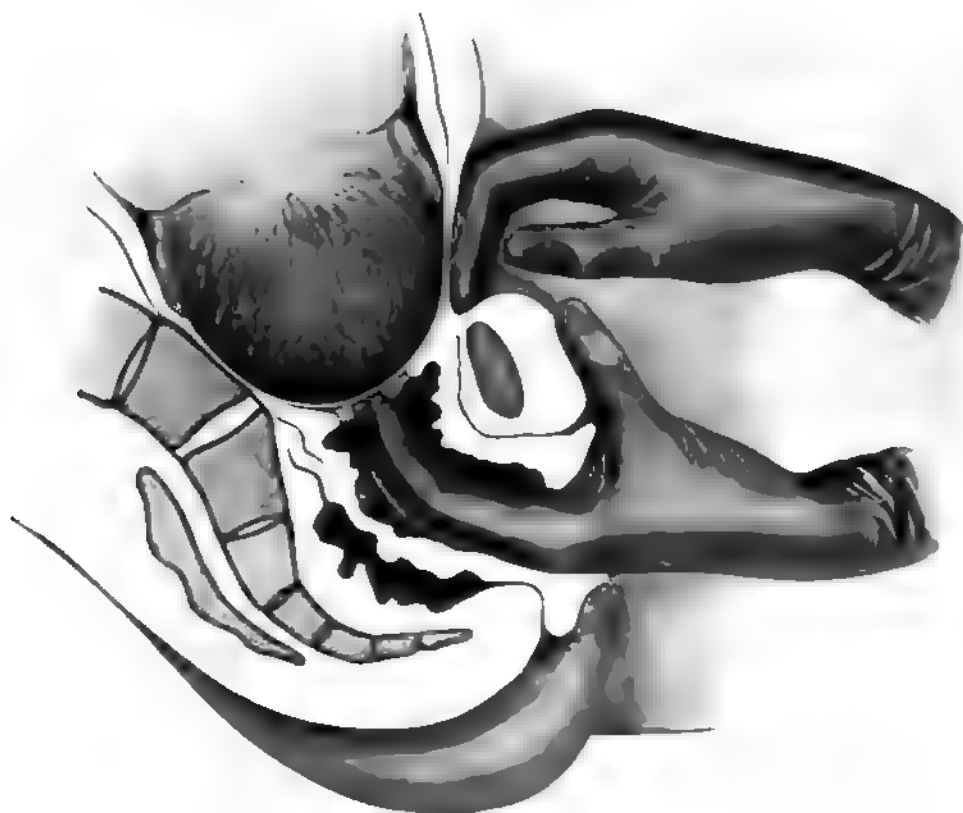


FIG. 622.—PALPATING HEAD AND ITS RELATIONS TO THE POSTERIOR SURFACE OF THE PELVIS. The head would probably not enter the pelvis. Part of examination may be as well made *per rectum*.

termines the hardness of the fetal head by the general impression of firmness of the bones conveyed to the fingers, the sharpness of the contour of the parietal bosses, the size of the fontanels (if almost obliterated, it shows hyperossification), the extent to which the bones overlap during the pains, and the breadth of the dome of the cranium. If the bones are soft, the dome is acute, while a hard calvarium is more flat. Previous children may have been large or small, with hard or soft heads, and the length of the present pregnancy must also be taken into consideration; also the size of the parents and the shape of their heads. Children that are carried overterm usually have large hard heads.

After getting as good a general idea as possible of the size and consistence of the child, the accoucheur tries to determine, by more direct means, if the head is likely to go through the pelvis. For this purpose it is better if the woman has been in actual labor until the cervix is effaced and pulled up out of the pelvis, thus

allowing the fetal head to apply itself more closely to the inlet. However, such conditions are not always met, and one has to form his judgment by allowing duly or disturbing factors. Fig. 652 shows the first maneuver. The head is forced down onto the inlet, the fingers inside steadying it, and it is then easy to find if the anterior parietal boss projects in front of the posterior surface of the pubis and how much. If the child presents with the occiput posterior, the forehead will be quite prominent in front, and this point must not be forgotten. A full rectum will also push the head forward. Müller's procedure consists in having an assistant force the head down into the inlet while the inside fingers determine how far it enters the pelvis. It has value only after the cervix is out of the way, because the soft parts will prevent the head from engaging under the amount of downward pressure it is possible safely to exert by the two hands. The most valuable of all is the determination of the degree of engagement. Reference has already been made to the criteria of engagement of the fetal head (see pp. 201, 207). If the vault of the pelvis is empty, the head being high and floating, in the absence of other causes for non-engagement the pelvis is probably much contracted; if the head enters the region of the inlet with a large segment projecting into the excavation and is more or less fixed, the accoucheur may feel fairly sure that the pains will succeed in molding it sufficiently for spontaneous delivery.



FIG. 653.—DETERMINING IF HEAD HAS REACHED INTERSPINOUS LINE.

The fingers touch the left ischial spine, then swing around pelvis to the right one, then touch the lowest portion of head. This may also be done per rectum.

Passing the fingers around the head and alternately touching the walls of the pelvis it is not hard to form a quite accurate conception of the degree of disproportion. Combined palpation of the head, like that used in estimating the size of the uterus, gives useful information. If the lowest portion of the head has reached the interspinous line (Fig. 653), engagement is usually certain. In flat rachitic pelvis the side walls are so low that this sign must be qualified. Here the lowest portion of the head must have passed this line by a little. The other signs—the covering of the sacrum and of the pubis—are also valuable, particularly the former.

Now a minute diagnosis of presentation, position, and attitude must be made. If the child presents in a frank O.L.A., the probabilities of a disturbing degree of pelvic contraction are not so strong. If the anterior or posterior parietal bone presents and the attitude does not correct itself under the influence of the pains, usually a badly contracted pelvis exists. The presence of anterior or posterior parietal

bone presentation generally must be taken as an indication of grave dystocia, though nature occasionally terminates such cases happily. However, in deciding beforehand whether a given head will pass through a given pelvis these abnormal presentations are very significant, because if they are very marked, the likelihood of a successful spontaneous delivery is remote.

A careful study of the uterine action is now in order. Good regular pains may overcome great resistances. Weak, infrequent, irregular, or cramp-like pains may be unable to terminate a labor otherwise normal. The nervous constitution of the woman will also require some attention. A nervous, impatient, unruly disposition, or even acute nervous prostration, may be the cause for interference when the mechanical disproportion is not great.

Finally, we have the test of labor, but the attendant's decision regarding his conduct of the case must be made before he trusts the case to nature.

For purposes of discussion it is customary to divide contracted pelves into four classes. It must be emphasized, at the very start, that such a division is purely arbitrary, because the size of the child is not considered, nor are any of the above-mentioned factors allowed for, but some common basis for discussion must be had.

- I. Pelves with a conjugata vera less than  $5\frac{1}{2}$  cm. in the flat, and 6 cm. in the generally contracted, variety. These are absolutely contracted.
- II. Pelves with a conjugata vera of  $5\frac{1}{2}$  to  $7\frac{1}{2}$  cm. in flat, and 6 to 8 cm. in the generally contracted, types. These are relatively contracted.
- III. Pelves with a conjugata vera of  $7\frac{1}{2}$  to 9 cm. in flat, and 8 to  $9\frac{1}{2}$  cm. in the generally contracted. These are moderately contracted.
- IV. Pelves with a conjugata vera over 9 and  $9\frac{1}{2}$  cm. respectively, and are border-line cases.

**I. In the absolutely contracted pelvis** no difficulty is met in deciding on treatment. A full-sized child cannot be delivered through it, and for this reason cesarean section is indicated whether or not the child is living. This is the absolute indication for the operation. If the woman is seen early in pregnancy, therapeutic abortion comes up, but the author does not recommend it, preferring cesarean section at term, under the ideal conditions always obtainable when the pelvic contraction is so timely recognized. If the accoucheur is called late in labor, when infection is probably present, Porro cesarean section is indicated or one of the newer modifications of the classic cesarean section, such as Latzko's extraperitoneal operation.

**II. In the relatively contracted pelvis** (conjugata vera,  $5\frac{1}{2}$  and 6 to  $7\frac{1}{2}$  and 8 cm.) decision also is not very difficult. Induction of premature labor is not recommended because of its very high fetal mortality. During labor at term careful consideration is needed. If the child is dead, craniotomy is indicated. A full-sized child cannot be gotten through the pelvis alive, and the question to decide is: Shall the mother be subjected to the risks of the classic cesarean section in order to save the infant? This is the relative indication for cesarean section, and it may be allowed only under certain conditions. If the woman has been in active labor a long time; if the membranes have been ruptured for many hours; if frequent internal examinations have been made, and by hands whose asepsis cannot be assured; if operative delivery has been attempted; if infection has begun or is suspected—certainly if the woman has fever or fetid discharge, the classic cesarean section from the relative indication is prohibited. If bad conditions do not exist, but the case has come early into the hands of a man capable of his task, uninfected, and in suitable surroundings, the cesarean section is the operation of election. In the first instance craniotomy is not alone justifiable, but demanded, and in the second instance the accoucheur must recommend the abdominal delivery. The facts are to be laid before the patient, the husband, and the family, and they must decide. Naturally, the accoucheur should guide them in the decision, and if they do not agree with



him, he should not be constrained to sacrifice the child when the conditions are ideal for cesarean section. Nor should he, when convinced that the disproportion is too great, allow the woman to labor until the right time for the abdominal delivery has gone by. He is at liberty to retire from the case under either circumstance, but must first provide, or see that the family provides, other medical assistance.

If craniotomy has to be performed because of pelvic contraction, the woman, the husband, and the family must be instructed that in the event of a subsequent pregnancy medical aid is to be provided early, and arrangements made for the cesarean section under ideal conditions. The accoucheur should not be asked to perform craniotomy a second time on the same woman. Such an operation today is unjustifiable, owing to the perfection of obstetric art.

An immense mass of literature has been accumulated on the question of the justifiability of craniotomy on the living child. In a paper published in 1901 (*American Journal of Obstetrics*, vol. xliv, No. 4) the author considered the subject in all its aspects, and has changed his opinions but little since.

Kossmann, Mann, Leopold, Olshausen, Schauta, Chrobak, and Knapp have written exhaustively on it and reached the same general conclusions. The stand taken by the Catholic Church is well known. Under no circumstances may human life be deliberately taken even when it is done to save another life. In Catholic families, therefore, the accoucheur is in duty bound to consider this aspect of the case, and the author makes it an invariable rule to remind the patient and family of this view of the Church, and to ask that the family priest be summoned to aid in their deliberations.

With few exceptions, all experienced writers are agreed that the sacrifice of the living child is still occasionally justifiable. The cases in which this is necessary are very scarce and becoming scarcer each year, there having been so much improvement in obstetric teaching and practice that severe dystocia is more often recognized early—in time for life-saving operations. Neglected and unrecognized dystocia still occurs, mistaken and unsuccessful operations are still attempted, aseptic care of parturients is still not universal, and infection is still common, so that when the accoucheur finally has to complete the delivery, he is usually glad to be able to save one life. Again, a woman may absolutely refuse to endanger her own life for her child, and this she has a perfect right to do. On the other hand, the necessity of sacrificing a perfectly healthy child almost never arises. When the patient reaches this point the child has nearly always been injured by long labor, by attempts at delivery, by being infected or having inspired infected liquor amnii, it very often dies within a few days, even if delivered alive. Furthermore, 30 per cent. of all children die before they are five years old. In comparing the life values of mother and child, these facts must be considered. (See also Coppens and von Oppenrooy.)

Without doubt, in former years too many children were sacrificed and infantile life was held too cheaply. Nowadays we are saving a great many by means of cesarean section and pubiotomy, but there is a tendency, as Chrobak observes, to go to the other extreme, and expose the mothers to greater dangers than the end justifies. As Chrobak says, "it almost seems we must protect the mothers against the children and that we forget that *salus matris suprema lex*." Since the vast majority of births occur, not in the large cities, where maternities and specialists are obtainable, but in towns, villages, and in the country, it will follow that many children will have to be sacrificed to save the mothers, and the accoucheur will deserve congratulations if, under trying circumstances and amid unfavorable conditions, he saves the mother. All accoucheurs, however, breathe one prayer—speed the day when craniotomy of the living child can be abolished!

In the last few years our success with extraperitoneal and cervical transperitoneal cesarean section in suspect cases has grown so that we are able to still further reduce the necessity for craniotomy. (See page 1036.)

**III. In the moderately contracted pelvis, those with a conjugata vera of  $7\frac{1}{2}$  to 9 cm., and 8 to  $9\frac{1}{2}$  cm. (in the flat and generally contracted types respectively), the most delicate questions and the greatest difficulties arise.**

*Treatment During Pregnancy.—Induction of Premature Labor.*—Since a small infant with a soft small head can usually pass through a moderately contracted pelvis and survive, we may make use of this knowledge and induce labor at a period of pregnancy when the child has not yet attained a size sufficient to block the pelvis.

Louise Bourgeois (born 1563, died 1636), midwife to Marie de Médicis, first recommended and practised the induction of premature labor to save the life of the mother, and gave as indication intractable hemorrhage. Roussel de Vauzelme, in 1778, recommended the operation in contracted pelvis, saying that Petit had practised it many years. In the middle of the nineteenth century the operation had a good vogue, and deserved it, because the mortality of cesarean section, symphysiotomy, and craniotomy was so high. As the technic and results of these operations improved the preference went to them, because of the high infant mortality and dangers and troublesome complications of induced labor, but even today the majority of authorities agree that the induction of labor after viability of the child is a valuable operation.



further, the soft parts may prevent the engagement of a head which a few labor pains can force through very easily. The decision as to the right time to begin is one of experience, and everything depends on the judgment of the accoucheur.

In primiparæ labor is seldom induced, since I prefer to see what the woman can accomplish at term; in multiparæ, the early operation is oftener performed.

Oliver, about 1858, recommended symphysiotomy in pregnancy, to provide the enlargement of the pelvis for delivery, and Frank practised it shortly before term. It is not advisable.

Rotter, in 1911, suggested the removal of a piece of the promontory to enlarge the conjugate, and Schmid in 1913 reported 8 cases in one of which delivery had been successfully accomplished.

*Prochownick's Diet.*—By reducing the carbohydrates and fluids ingested during the last two months of pregnancy Prochownick hoped to restrain the growth of the child, and also to retard the ossification of its bones, so that it would mold through the pelvis easier. The diet he prescribed is presented here, but my few experiences with it have been absolutely negative, and, indeed, daily observation in other cases, for example, tuberculosis, carcinoma, hyperemesis gravidarum, show that the nutrition of the mother has little effect on the growth of the child, which is, in fact, a parasite. In Germany the war ration of the mothers has shown increased weight of the babies (Stoeckel).

*Breakfast.*—Small cup of coffee. One ounce of toast.

*Dinner.*—Small piece of meat or fish, or an egg, a little sauce, a vegetable prepared with fat, lettuce, a small piece of cheese.

*Supper.*—The same with a few slices of bread and butter and a little milk.

Water, soup, pastries, potatoes, sugar, and beer are forbidden. About one pint of water daily is allowed.

Patients living on this dietary require constant medical supervision. Nephritics may not be put on such a diet.

*Treatment of Moderately Contracted Pelves During Labor.*—In the first stage the question to decide is, shall we interfere at once or shall we await the test of labor?—interference or watchful expectancy? In primiparæ, when the parturient is not quite at term, in cases where the child does not seem very large, or where the pelvic contraction is near the upper limit, with the conjugata vera 9 to 9½ cm., and where the probability of good strong pains seems good, my advice is to wait and see what nature will accomplish. The pains slowly mold the head into the inlet, and disproportion that seemed insuperable is finally overcome, or the head forced so low that it can be easily extracted by the forceps. We can hope for such a termination in 75 per cent. of the cases.

When the conditions are the opposite; when the careful, complete examination shows that the disproportion between the child and the pelvis is one that is not likely to be overcome by the natural forces; if the presentation and position are bad; when the history of previous labors is unfavorable or the general constitution of the woman such that a severe parturition cannot be borne—cesarean section is the operation of choice.

If the test of labor is to be given, an extraordinary degree of watchfulness is demanded. The rupture of the membranes is to be prevented by keeping the patient on her side, forbidding bearing-down efforts, care during internal examinations, and by the insertion of a soft colpeurynter, not tightly filled, in the vagina. When dilatation of the cervix is complete, the membranes may be allowed to rupture in order to permit the head to apply itself snugly to the inlet and complete the molding process. Molding may begin in an intact sac. Should the membranes rupture before the cervix is completely dilated, the colpeurynter—now preferably a Voorhees bag with flat top—is placed inside the cervix. This keeps the head from exerting injurious pressure on the bladder, prevents incarceration of the anterior lip of the cervix between the head and symphysis, preserves the liquor amnii left in the uterus, strengthens the pains, and helps to dilate the cervix. During the first stage an attempt may be made to bring the head into a good position over the inlet. For example, it may be possible, by manually correcting a posterior or anterior parietal bone presentation, to place the head in a way to enter the pelvis easily. By using the crouching position, with one knee up, a head which has slid off the inlet into one iliac fossa may be led back over the inlet (Fig. 654). Hof-

meier's impression of the head from the outside may also be tried, but I have never thus succeeded in accomplishing any real results. It is not entirely safe. The hands may bruise the lower uterine segment or compress the cord lying around the neck. Naturally, in such prolonged labors, and with so frequent vaginal manipulations, the dangers of infection are increased. Special attention must be paid to the bowels, since a full rectum may prevent engagement. The same is to be said of the bladder. Bloody urine and frequent desire to urinate indicate injurious pressure on the bladder, which perhaps will result in gangrene and fistula.

At the end of the first stage, and in the beginning of the second stage, the parturient may be placed in the Walcher position (Fig. 655). Walcher discovered that the conjugata vera could be lengthened by hyperextension of the thighs with the pelvis fixed. The softening of the pelvic joints in pregnancy permits the sacrum to become movable, and by dropping the legs, for example, over the edge of the table on which the sacrum is fixed, the innominate bones rotate downward, enlarging the inlet. Owing to the oblique direction of the articular processes of the sacrum, this



FIG. 654.—CROUCHING OR INDIAN ATTITUDE.  
Only one knee is up.

motion naturally causes the lower ends of the innominates to approach each other and narrow the outlet.

Mercurio, in 1589, and Melli, in 1738, used this position to facilitate delivery. The true conjugate may be lengthened from 6 to 12 mm., especially in flat pelvis. In practice the woman's legs are warmly covered, the pelvis brought to the very edge of the bed, and the feet dropped out straight onto a soft pillow. In a few cases I have gotten the head to enter the pelvis by this procedure, but it is very painful, and few women can be compelled to keep it up over twenty to forty minutes.

My results, curiously, have been better by the use of the exaggerated lithotomy position (Fig. 495, p. 588), which is theoretically contraindicated because it contracts

inlet. The thighs force the uterus up, correcting the pendulous belly so common with contracted pelvis; the uterus and child are straightened out, the former thus allowed to act with more directness, and the latter being brought into a better position over the inlet. It is also possible that an occasional parietal bone presentation is corrected. The exaggerated lithotomy position may be kept for several hours or repeated at intervals. When the head projects into the pelvis with a large segment, the patient is instructed to bear down, to aid in the delivery. Three dangers must now be watched for—*asphyxia* of the child, *exhaustion* of the mother, and *rupture* of the uterus. The advance signs of these dangers will be described in appropriate chapters. How long the parturient may be allowed to labor depends on the judgment of the accoucheur. Every hour a



FIG. 555.—THE WALCHER POSITION.

an examination is to be made to measure the progress, and if there is a little, and none of the three dangers impending, it is safe to wait. It is unwise to allow the second stage to continue much over four hours if the pains are strong and the head wedged into the inlet. *Fistulas* are apt to result, and the child's brain may suffer injury.

If spontaneous labor does not occur, there are five operations that come up for consideration—*VERSION*, followed by *EXTRACTION*; *HIGH FORCEPS*; *EXTRAPERITONEAL UTERINE SECTION*; *HEBOSTECTOMY*, and *CRANIOTOMY*.

*Version* is performed only when the head is freely movable, before the lower uterine segment has thinned out enough to invite the danger of rupture during the manipulation and in cases of abnormal presentation, position and attitude, for example, shoulder, face, brow, anterior and posterior parietal bone presentation, and prolapse of the cord. Prophylactic version means version by breech during or at the end of the first stage of labor in contracted pelvis. The term was introduced by Fritch. Simpson showed that the after-coming head passes through the pelvis



inside the joint. The gain in space is the same with the two operations (Cusmano). Symphysiotomy had a mortality varying from 3 to 12 per cent. for the mothers, and 9 to 19 per cent. for the children, and, taking the results of nine of the best operators together, 6.78 per cent. for the mother and 10.6 per cent. for the children. At the operation severe hemorrhage from the wound, particularly when there were varicose veins, extensive injury of the anterior vaginal wall and the perineum, tearing of the levator ani from the rami pubis, the lacerations communicating with the joint, tearing of the bladder and urethra, overstretching of the sacro-iliac joints, with rupture of

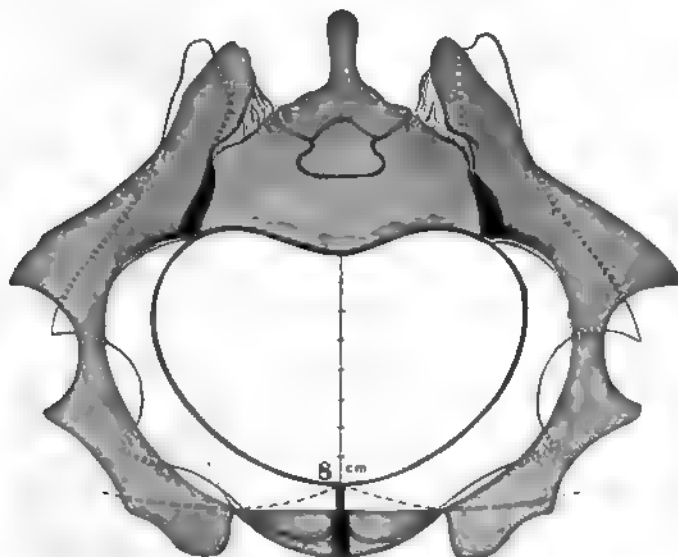


FIG. 656.—ENLARGEMENT OF THE PELVIS IN SYMPHYSIOTOMY (from Farabeuf and Varnier). The area of inlet is augmented about 50 per cent. Note how the head may utilise the gap between the severed bones.



FIG. 657.—X-RAY EIGHTEEN MONTHS AFTER HEBSTEOTOMY.

air anterior ligaments, hematoma around the joint (more with hebstectomy) were reported with great frequency. In a few cases bony union of the pubis, requiring the saw, and ankylosis of the sacro-iliac joints, necessitating final resort to craniotomy and cesarean section, were met. Convalescence was frequently interrupted and prolonged by infection of the wound and pyemia, because of poor drainage, the poor healing qualities of the cartilaginous joint, the proximity of the optic vagina, and the frequent tears communicating with it. Hematomata; thrombosis in the veins and embolism; slow healing of the joint, with prolonged sickness in bed and difficulty of locomotion later (in two of the author's cases locomotion was impaired two and eight months

respectively); loss of control of the bladder; descensus and prolapse of the uterus; dislocation and distortion of the base of the bladder and deforming scars of the soft parts; and hernia between the bones were other accidents and sequelae. The union of the joint was never bony, but after several months a sufficient degree of firmness was attained. A good feature of this fibrous union of the joint became evident in subsequent labors. The softening and relaxation of the symphysis were so great that spontaneous delivery was allowed. This occurred in two of my cases.

Hebosteotomy aims to avoid some of these dangers, and, indeed, the mortality is less for the mother, though about the same for the child, and the morbidity is less. Since the cut in the bony ring is made at the side of the joint, the structures around the latter, the urethra, the bladder, the clitoris, the large venous plexuses, etc., are a little less liable to injury. It is said that by making the operation practically subcutaneous, the danger of infection is lessened; tears communicating with the vagina are rarer; severe hemorrhage is rare; the operation requires less skill (?); convalescence is quicker and simpler.

Schläfli, in 1907, reported 700 hebosteotomies with a maternal mortality of 4.96 per cent. and a fetal of 9.18 per cent., but individual operators (Williams, Stoeckel) have had series of 6 and 24 cases without a maternal death (Roemer).

Roth, in 1914, reported 85 cases with 2 maternal and 7 fetal deaths.

	SCHLÄFLI (1908) IN 700 CASES FOUND:	ROEMER (1911) FOUND
Severe hemorrhage.....	15.00 per cent.	15.40 per cent.
Fatal hemorrhage, two cases.....	0.00 " "	0.33 " "
Hematoma.....	17.00 " "	14.00 " "
Vagina tore into wound.....	15.00 " "	7.00 " "
Deaths of these latter.....	12.60 " "	3.90 " "
Injury to bladder.....	12.30 " "	5.20 " "
Fever postpartum.....	31.70 " "	20.60 " "
Thrombophlebitis.....	8.00 " "	3.50 " "
Incontinence of urine.....	4.00 " "	0.00 " "
General (corrected) mortality.....	4.37 " "	2.66 " "
General (corrected) fetal mortality.....	9.18 " "	6.66 " "

Operators of the largest experience have discarded hebosteotomy in primiparae, and will not perform it in cases complicated by heart and kidney diseases, infection of the parturient canal, extreme obesity, colossal varicosities of the genitals, and extremely large child.

On the Continent the enthusiasm, which reached its acme at the Dresden Congress of German Gynecologists, has undergone a complete reversal, and at the Strasbourg Congress a few years later not a voice was raised for hebosteotomy.

While the mortality is not very high, the bladder and urethral injuries, the hemorrhage from the wound, the hematomata, the extensive lacerations, the frequency of fever in the puerperium, of thrombosis of the pelvic and crural veins, the delayed convalescence, and the trouble of locomotion (more frequent than reports show) explain the loss of popularity of the operation. Lately successful series have been reported by Stoeckel, Williams, and a few English and American accoucheurs, and, without doubt, the operation has been too quickly condemned. My own experience has been favorable. Performed under proper restrictions, for the correct indication, and by a competent accoucheur, it will hold a permanent place in obstetric surgery. In general, its field will be limited to pelvis having a true conjugate of not less than 7.5 cm. when the conditions for cesarean section are not ideal.

When, in a multipara, in a case of the type under consideration—of moderate pelvic contraction—expectancy has shown that the head is too large to go through spontaneously, and a gentler trial with the forceps has proved the disproportion to be greater than was expected, hebosteotomy is the operation of choice, provided both mother and child are in good condition. The only time for the classic cesarean section is gone by, but the section of the pubis offers excellent chance of saving the two patients. This is an advantage of pubiotomy—it enables us to subject the woman to the test of labor. (See page 947 for history and description.)

**Extraperitoneal Cesarean Section.**—This is an operation with an incision just above the pubis by which access is gained to the lower uterine segment and the child delivered without entering the peritoneal cavity. (See p. 1035 for details.) The reception the new operation got in 1906, 1908, and 1909 was very enthusiastic, because the hope was revived that at last it would be possible to do away with craniotomy on the living child when the conditions were not good for the classic cesarean section. Experience, however, has shown that these dangers beset the operation: (1) The peritoneum is sometimes opened unintentionally; (2) the bladder is sometimes torn; (3) hemorrhage from the veins may be alarming; (4) the immense space in the connective tissue is liable to hematoma formation or infection, with abscess, which may break into the peritoneal cavity; (5) thrombosis of the immense veins laid bare and embolism; (6) infection and peritonitis, the thin layer of peritoneum not offering an efficient barrier; (7) difficulty of technique; (8) the fetal mortality is high. With proper technic, and this has been much improved of late, most of these dangers are avoided.

Another method of cesarean section has come into vogue on the Continent, and bids fair to entirely replace the classic in clean cases, and to acquire a field of its own in obstructed labor under unfavorable conditions. It is a cervical transperitoneal operation, and, while the peritoneal cavity is opened, the intestines are not disturbed and the field not soiled by the uterine contents (see p. 1038). There are many other advantages in this method which has now become the one of pre-



erence with the author, and it may be used where the classic cesarean section is absolutely contra-indicated. Fränkel, Veit, and Fehling have almost abolished craniotomy on the living child by means of this suprapubic, transperitoneal, cervical cesarean section. It has also in many hands displaced the extraperitoneal method, but Küstner and Stoeckel prefer the latter for infected and neglected cases.

While I insist that in frankly infected cases (fever, high pulse, foul liquor amnii, gray exudate on vulvar wounds) all forms of abdominal delivery are too dangerous, especially as in such conditions the child's life is already compromised (injury from long labor, from attempts at delivery, from infection), yet experience has shown that the newer operations offer much hope of success where the conditions are not too bad.

There is a field now claimed by hebosteotomy where labor has advanced to a point which convinces one that the head will not enter the pelvis. Dilatation is complete, and an indication for delivery present. In multiparæ, without extensive varicosities and where the disproportion between the head and the pelvis is not very great, I recommend a trial of the forceps followed by pubiotomy, otherwise cervical cesarean section is the choice. If infection is frankly established even hebosteotomy is too dangerous, but if it is only suspected from external circumstances (examinations by ungloved hands, prolonged exhausting labor, attempts at delivery)—Latzko's extraperitoneal cesarean section is selected.

These operations are slowly gaining recognition in this country. Hirst, Kelly, Gellhorn, and the author recommend them, as also does Williams, though less enthusiastically.

**Craniotomy.**—When the child is dead, craniotomy should be performed as soon as the cervix is large enough to permit it, i. e., 9 cm. across. If the child is dying, or if, in the judgment of the accoucheur, its life has been compromised by prolonged compression in labor, or it has been damaged by attempts with forceps or version, craniotomy should be done. The accoucheur may not plume himself on the success of having delivered the child alive, when it succumbs in a few hours or a few days to the results of labor. The mother has invariably suffered severe injury, and has often been killed by the forced delivery, and these accidents must be charged against the attendant. Craniotomy is much safer, and the end-result for the baby the same. (See Davis.)

With the child in good condition, craniotomy should be the rarest of all operations, but—and practically all authors agree—a few conditions arise where it must be resorted to as the ultimate refuge: (1) If the patient absolutely refuses to incur any danger to herself for the sake of the infant. The operation is, however, not to be repeated in a subsequent labor. (2) If labor has been prolonged and infection is positively or probably present. (3) Where expectancy and high forceps have failed and the conditions are not good for hebosteotomy—for example, an ankylotic pelvis, immense varicosities of the vulva, extreme obesity, nor for the newer cesarean section, see above.

**IV. Treatment of Labor in Pelves only Slightly Contracted.**—*Pelves Contracted at the Inlet.*—In pelves with a conjugata vera of  $9\frac{1}{2}$  to 11 cm. labor almost always terminates spontaneously, unless the child is very large, in which case the pelvis is thrown back into the class of the "moderately" contracted, just considered. Variations in the mechanism of labor, however, are very common, and the cause for breech, face, brow, and shoulder presentations, for occipitoposterior and other malpositions, and for errors of attitude, as prolapse of the cord, the hand, etc., is often to be found in a slight pelvic contraction which would otherwise pass unnoticed. Operative deliveries, which in normal pelves would be simple, easy, and typical, become, when slight contraction exists, unexpectedly and unexplainedly difficult and complicated. When dystocia arises in such a pelvis the treatment is the same as that just described under Moderately Contracted Pelves.

*Pelves Contracted at the Outlet.*—As a rule, the obstruction offered by the narrow bony outlet is not recognized until the head has been arrested at this point for several hours, and often the forceps are applied in ignorance of the true conditions. Engagement of the head is the rule, unless, in addition to a narrow outlet, the pelvis is roofed over by a projecting spinal column—*pelvis oblecta*—as in the kyphosis and the spondylolisthetic forms. It is wise, before every forceps operation, to measure the distance between the tuberosities and see how far the sacrum and the coccyx encroach on the anteroposterior diameter of the outlet.

If the anomaly is discovered in pregnancy or early in labor, what was said under the general heading applies here also. If it is found only after dystocia is manifest, the following is suggested: (1) The exaggerated lithotomy position, recommended by the author more than fifteen years ago (Fig. 495, p. 588). This opens the bony outlet and often produces enough enlargement. Experiments on the cadaver show a gain of  $3\frac{1}{2}$  to 5 mm. in the transverse diameter, and also, according to Williams, decided enlargement of the anteroposterior. (2) Jonge's position,

the same but with the legs extended (Fig. 658), is said to enlarge the outlet still more—even 9 mm. Krug suggested pulling the tuberosities apart directly with the hands. (3) Prolonged expectancy—but during the period of molding the possibility of pressure necrosis of the maternal parts and injury to the brain of the fetus must be borne in mind. (4) The forceps—in mild degrees of contraction this instrument will usually succeed, but a large number of babies are killed by the operation, and the mother almost always suffers severe lacerations, which may extend through the vaginal walls into the ischiorectal fossa and down to the bone. In one case it was possible to put the hand into a wound which extended up into the false pelvis, the soft parts having been dragged off their pelvic attachments. Rupture of the



FIG. 658.—Jones's Position. *Lancet*, August 1, 1909, p. 157.  
At the St. Mary's Hospital, Chicago.

symphysis pubis has been frequently reported, and occurs oftener than published. If the child is in good condition when the first real difficulties of the operation are experienced, heliotomy is the operation of choice; if it is not in good condition, craniotomy is to be done. Primiparae suffer the worst from this anomaly. In multiparae, the resistance of the soft parts being absent, a small amount of outlet contraction may cause little trouble. Indeed, may pass unnoticed.

**Complicated Labors in Contracted Pelves.**—Labors complicated by abnormal presentations and attitudes of the child require many modifications in the treatment. In breech, shoulder, brow, and face presentations it is impossible to await onset of labor and also to fit the head to the pelvis as we do in vertex presentations.

**It is, therefore, necessary to estimate the degree of spacial disproportion from the pelvic measurements and the adjudged size of the child. The choice of the operation will lie between prophylactic version, cesarean section, and hebosteotomy.** Von Franquè suggested applying the hebosteotomy saw provisionally around the joint, to perform extraction, or version and extraction as indicated, and, **if the after-coming head is arrested at the inlet, the bone could be immediately sawn through and delivery thus quickly effected in time to save the infant. This is an ingenious suggestion, but, in my opinion, impractical and dangerous. If hebosteotomy is to be done at all, it should be the primary operation. Version is particularly unfavorable to the child, because, unless the narrowing of the passage is very slight, the after-coming head will be stopped at the inlet, the infant will die, and craniotomy will have to be performed. Therefore, in breech, shoulder, and deflexion presentations, unless the accoucheur is convinced that the child will go through the pelvis, cesarean section should be performed as a primary operation—given, of course, good conditions.**

Placenta prævia complicating contracted pelvis demands cesarean section if the child is alive, and craniotomy if it is dead. It is doubly dangerous to drag a large child forcibly through the thinned lower uterine segment. Abruptio placentæ demands cesarean section if the cervix is closed. Even rigid soft parts may render the abdominal delivery safest.

Eclampsia seems to be a little more frequent in contracted pelvis. It also makes cesarean section more readily chosen, and the same may be said, speaking broadly, of all other complications requiring rapid delivery.

**Hospital versus Home Practice.**—The foregoing presentment of the subject gives the treatment of contracted pelvis in the author's own and hospital practice. Without question great differences in treatment must exist between that of the specialist, aided by maternity facilities, and that of the general practitioner, caring for his patient in a flat, or a farm-house, or even a "lean-to," with no help but a nurse or the neighbors. In cities and towns the parturient can and should be transported to a well-equipped maternity, but under the conditions surrounding the birth of the majority of children this is seldom practicable, and, unless the maternity facilities can be closely imitated in the home, the accoucheur will have to adapt his treatment to the environment he finds. This is particularly unfortunate for the child, because cesarean section and hebosteotomy are very dangerous performed under such conditions, and, therefore, inadvisable.

Prolonged expectancy is the best treatment for all but the absolutely contracted pelves, followed by a trial with the forceps, failing which craniotomy is the horrible ultimate. If the head is movable, or if the presentation and attitude are abnormal, version is indicated. A high infant mortality is to be expected, but the information gained will warn the attendant to provide ideal arrangements for subsequent labors, and, in the end, a larger number of children will be saved than if the attendant tries to force the conditions in a bad environment. The same statement should apply to prolonged and brutal attempts at delivery with the forceps. A short trial will convince the operator that they are powerless to effect delivery, and if the tractions are persisted in, they can result only in irreparable damage to the mother, and the object sought, a living child, is almost always defeated by the attempt itself. Craniotomy is more humane. A careful study of his pregnancy cases will enable the accoucheur to foresee the above dangers, and, by proper provision, avoid them.

**What to Tell the Patient After Labor in Contracted Pelvis.**—An inquiry as to the outlook in future pregnancies is the rule after difficult labors, and in order for the accoucheur to be able to express an intelligent opinion he must have carefully observed and noted the character of this labor, the resistances met, the size of the child, etc., etc. He should resist the temptation to magnify the difficulties encountered, either to add to his glory in a successful termination of the case or to

excuse his failure. He must carefully distinguish between dystocia from spacial disproportion and that from errors of mechanism—also from errors of art.

In cases of absolutely contracted pelvis the advice is simple—cesarean section every time until it is decided to sterilize the patient. In relatively contracted pelvises the patient is advised that cesarean section just as labor begins will probably be the method of election. In moderately contracted pelvises the patient may be encouraged by the statement that perhaps, since the soft parts as obstruction have, to a great extent, been eliminated, labor will not be so difficult and may terminate spontaneously. If the child was postmature and large, the induction of labor before term may be recommended for the next pregnancy, and in all events careful supervision must be demanded.

Lacerations in clean cases are always to be repaired at once. In known infected cases the cervical tears, the perineal wounds are left open for drainage, but always a few stitches should be put in to unite a torn sphincter ani. Late repair of lacerations is not to be recommended as a routine. I usually advise the patient to have several children first, and then submit to a complete plastic. The scars from operation would add to the dystocia and they almost always tear again and again. If cesarean section is to follow, of course the plastics may be done.

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# CHAPTER LIX

## THE ACCIDENTS OF LABOR

### INJURIES TO THE PARTURIENT CANAL

#### THE VULVA

ALL primiparæ and many multiparæ suffer from injuries of the parturient canal. These are generally considered normal, but why, the author cannot understand—no other function of the body is always attended by injury. In primiparæ the most frequent lesions are found about the vulvar orifice. Fig. 659 shows the most common vulvar lacerations. They are seldom deep, but if they involve important structures, serious results may follow. If the tear extends through a crus of the clitoris, or even through the organ itself, severe and even fatal hemorrhage may ensue. If a varicose vein is opened, the patient may die from loss of blood. If the duct of the gland of Bartholin is torn across, a cyst may form. If the urethra is involved, a stricture may follow. These wounds often become the seat of puerperal ulcers, and if the infection is virulent or the woman's resistance low, invasion of the connective tissue, even general septicemia, may be the outcome. These lesions are often associated with vaginal tears. Superficial wounds—simply splitting the skin and mucosa—require suturing but seldom, since their edges usually lie in apposition when the legs are brought together. Hemorrhage from clitoris tears and those involving varicose veins is easily stopped temporarily by pressure between the finger and thumb, or by a gauze sponge, and permanently by a draw-string, fine catgut suture through the base of the wound. Often compression is enough. Frenulum tears should be sutured.

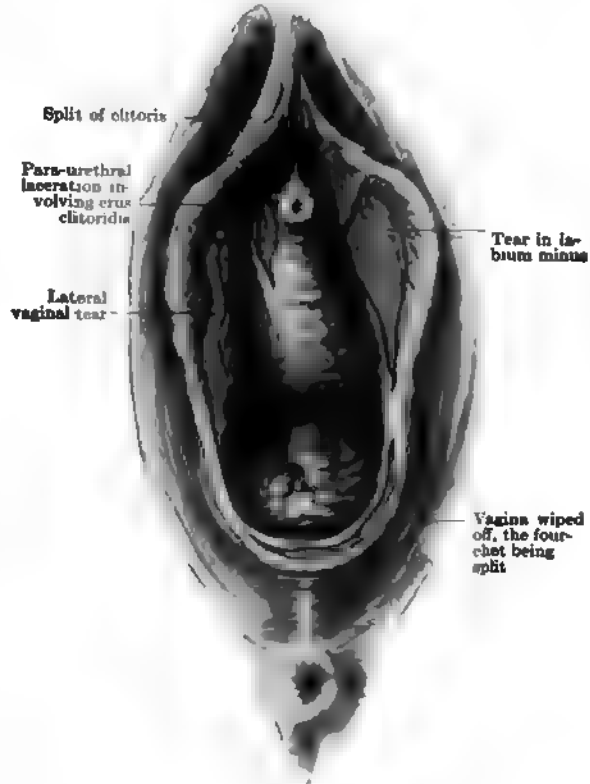


FIG. 659.—TYPICAL VULVAR INJURIES.

Rupture of the urogenital septum is an inevitable injury in labor, and it cannot be fully repaired. Some relaxation and descensus of the anterior vaginal and urethral wall is an invariable sequence, and it not seldom leads to a slight catarrh at the neck of the bladder—the so-called "irritable bladder" of the older writers. During labor attempts to push the protruding urethra back out of the way of the advancing head always fail, and the urethra is wiped off its pubic attachments.

## THE PERINEUM AND PELVIC FLOOR

If, with the index-finger in the rectum and the thumb in the fourchet perineal body be squeezed together, the examiner will be surprised to find how little tissue there is in it. Indeed, it is composed only of a little fat and connective tissue—the centrum tendineum—with the rudimentary muscles, the constrictor ani, the muscoli bulbi cavernosi, a few levator ani fibers, and the transverse perinei. The fingers will easily outline the sphincter ani, the important circular muscle of the rectum, and, at the sides, the strong rounded masses of the levator ani coming down from the pubis to grasp the rectum from behind. Lacerations of the perineal body occur in the majority of primiparous labors, and while they are of considerable importance, it is decidedly less than tears of the pelvic floor—the levator ani and the fascia in which it is set. When the perineal body is



Pubococcygeus portion.  
Tears at either side of raphe.

FIG. 660.—RECTOCELE SEPARATION OF THE LEVATOR ANI. (LOCALLY THE ANTERIOR PORTIONS OF THE MUSCLE ARE TORN AT THE SAME TIME.)

the urogenital septum is destroyed, the anterior wall of the vagina sags, the posterior vaginal wall begins to roll out, and the vulva is permanently open, inviting infection, which almost always results in a vaginal and cervical catarrh. Late effects are descensus uteri and chronic metritis. If the tear is deeper, it may involve in part or all the sphincter ani, or even run up the rectal wall more or less. I have seen the rectum torn for a length of three inches beyond the sphincter. Complete incontinence of feces is the first effect of such tears, but if they are not extensive and the levator ani is not seriously injured, the latter muscle assumes vicarious control of the bowel, and the patient may be able to hold the hardest feces. Soft feces and gas, however, will usually pass off in spite of the woman's efforts.

The levator ani is always injured in labor. Either it is overstretched, which means that there are innumerable microscopic tears of the muscular fibers, or some of the muscular bundles are torn, or there is a deep laceration of one or both sides of the sling-like structure. The last kind of injury may be discovered

labor, but the other two usually pass unnoticed because they are unattended by a laceration of the vagina. The latter is too elastic to tear, but the muscle gives way under the mucous membrane. Such cases come to the accoucheur later with the

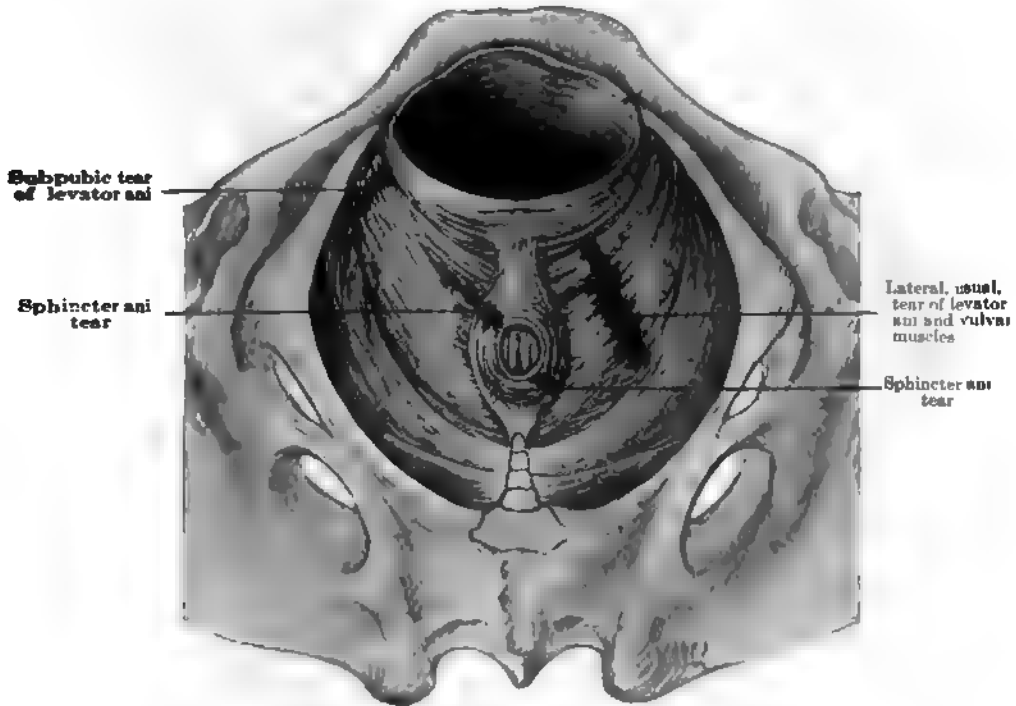


FIG. 661.—SITES OF RUPTURE OF THE MUSCLES IN THE PELVIC FLOOR. NOTE, SELDOM MEDIAN.

history of no tear during labor, and he diagnoses them "relaxation of the pelvic floor." On several occasions I have attempted to shorten up the stretched muscle after labor by deep sutures tied across the intact vaginal mucous membrane. Rare

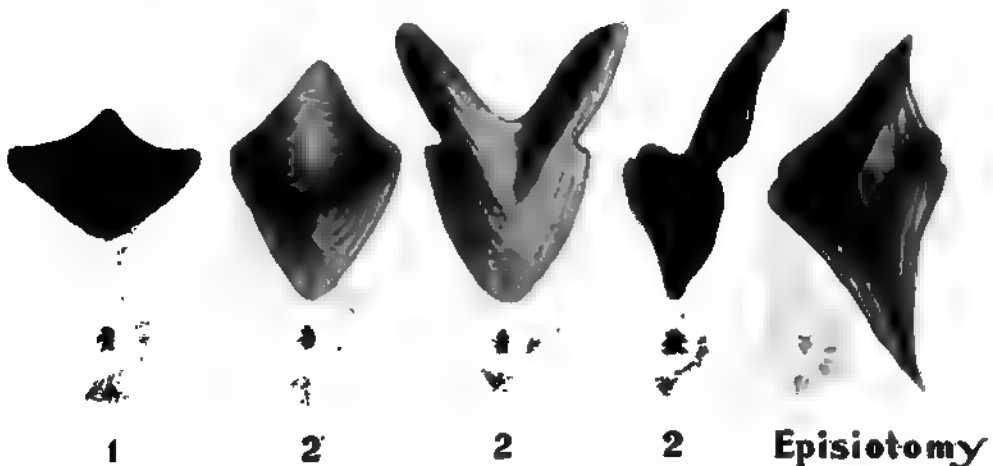


FIG. 662.—DIAGRAMS OF THE TYPICAL PERINEAL INJURIES.  
1, First degree, 2, 2, 2, second degree, tears.

instances of submucous laceration of the sphincter ani are on record. Displacement of the muscle occurs. It is pushed downward by the advancing fetal part

and loosened from its bed in the fascia and from its interlacement with the rectum. Its two puborectal bundles are pushed asunder, leaving a wide breach. After healing has occurred, instead of a thin, flat, sling-like muscle we find a thick fat deposit forming two pillars at the sides of the gaping introitus, with the rectum pouching between them. This widening of the hiatus genitalis is favored by the distraction of the fibers of the levator ani which lie anterior to the rectum under the vaginal apex of the centrum tendineum, and by the tearing of the fascia visceralis which accompanies these fibers.

Lacerations of the tendinomuscular pelvic floor may be unilateral or bilateral and the puborectal portion of the muscle is usually involved. In a large number

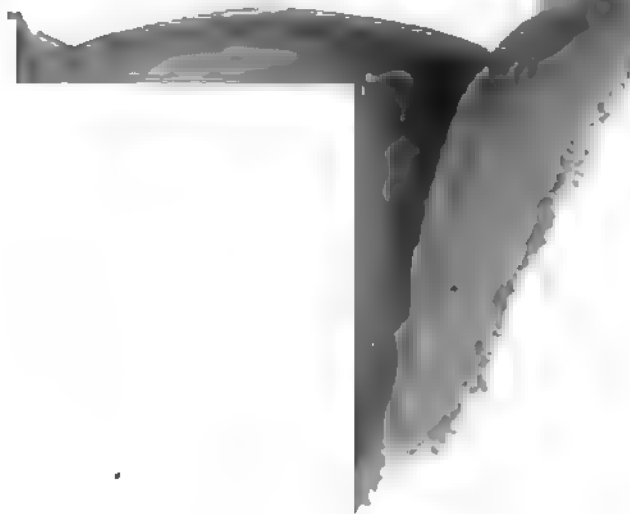


FIG. 663.—CENTRAL RUPTURE OF PERINEUM. ANUS AND VULVA INTACT.  
Child emerged through rent.

cases I am convinced that in addition to being pushed off the rectal wall, the two halves of the muscle separate at their junction behind the rectum in, or alongside the raphé which leads from the coccyx to the anus. (See Fig. 181, p. 164.) This allows the anus to fall back toward the coccyx, and leaves the two halves of the levator as pillars on each side of the gaping vagina (Fig. 660). Perfect anatomic repair of such a rupture is not possible with our present methods of operation. It will be necessary to gain access to the torn ends of the muscle from behind the rectum.

Sometimes the muscle is torn directly away from its attachments to the posterior surface of the pubis (Fig. 661), such injuries being usually the result of forced forceps deliveries, attended by attempts to rotate the head with the instrument. When a tear of this kind is extensive, the bladder lies naked at the top of the wound and the angular vaginae are abruptly from the pubis. In the lateral tears the mucous membrane of the vagina is also torn in the sulci, and if both sides are affected, the columna rugarum lies, tongue-shaped, at the bottom of the wound.



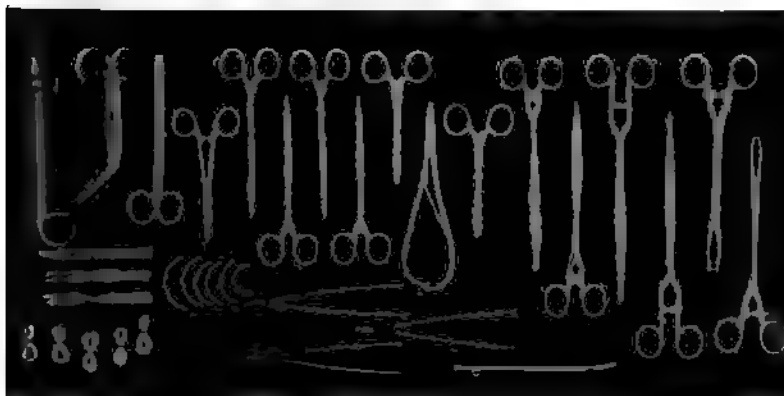


FIG. 664.—INSTRUMENTS NEEDED FOR PERINEORRHAPHY.

scalpels; 6 artery clamps; 2 8-inch clamps; 2 needle-holders; 2 cervix ring forceps; 2 Allis' forceps; 2 vulsellum forceps; 3 tissue forceps; 3 specula; 1 uterine packing forceps; 6 needles; silkworm-gut and catgut.



FIG. 665.—Tissue Forceps with Spoon-shaped Ends.

Holds tissues firmly without injuring them, and also removes one source of danger to rubber gloves.

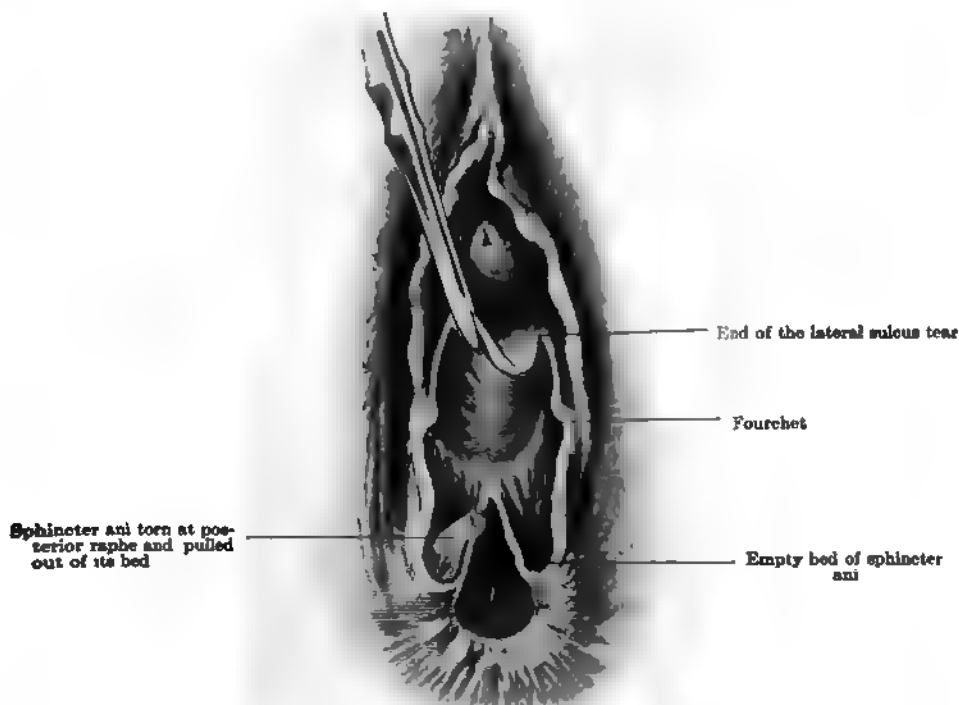


FIG. 666.—COMPLETE ON THIRD DEGREE TEAR. CRITICAL SURVEY OF THE WOUND.

Shows the depth of the wound and how the flap of the vagina may be raised. The split in the rectum and the sphincter, torn out of its bed and ruptured at the side (not in the middle line, as is commonly thought), are plainly shown.

Fig. 662 shows the various forms of the perineal and pelvic floor injuries as they appear after labor. All the figures were drawn from life.

**Etiology.**—Perineal tears occur with a frequency varying from 9 to 34 per cent., as put by different authors. Forceps labors show 54 to 85 per cent. of tears. In my own experience an anatomically absolutely intact perineum is a great rarity, but extensive lacerations are uncommon, because I use episiotomy often.

The most common cause of perineal lacerations is disproportion between the

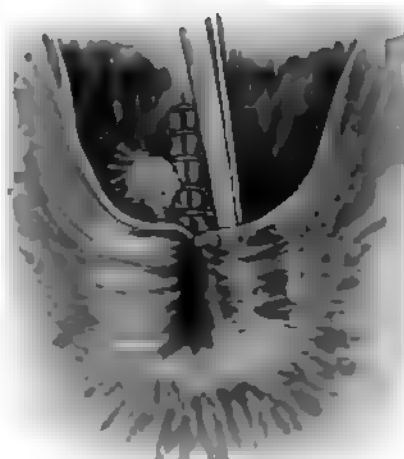


FIG. 662.—THE VARIOUS FORMS OF THE PERINEAL AND PELVIC FLOOR INJURIES AS THEY APPEAR AFTER LABOR. ALL THE FIGURES WERE DRAWN FROM LIFE.

aching the levator ani and perineum. We find, therefore, the most extensive in funnel pelves and those with a narrow pubic arch. In these cases, too, the round its outlet, being caught between the head and the bones, is forced or if the delivery is operative, downward and outward, and if, in addition to the



FIG. 670.—UNITING THE SPHINCTER ANI.

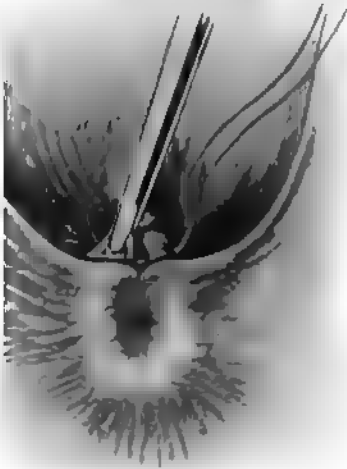


FIG. 671.—REINFORCING SUTURE ABOVE SPHINCTER ANI.

A finger-cot or, better still, an extra rubber glove, is drawn on, the index-finger inserted into the rectum, and a suture is now passed above the sphincter ani from the skin surface, using silkworm-gut. This reinforces the catgut suture and brings together the skin fibers of the sphincter ani externus, and the lowest portion of the torn urogenital septum containing the transversus perinei superficialis and some connective tissue of the centrum tendineum. Sometimes this stitch turns the skin of the anus in a little, hence the edges of the skin where it joins the mucosa are united by a fine catgut suture.

The rest of the operation is like those for incomplete tear.

FIG. 670.—UNITING THE SPHINCTER ANI.

For broad apposition of the torn ends of the needle should pass well to the side, and two sutures may be placed, one of which should encircle the muscle. This is the last part of the operation, and plenty of time must be spent on it. No. 2 twenty-day catgut is used.

In cases of lacerations, rotatory movements are made with the forceps, the vaginal walls are completely off their pelvic attachments and are split in several directions. In deeper lacerations, involving the muscles of the pelvic floor, take place within outward, first the muscle tearing, then the vagina, which is first visibly

spanned transversely, and, finally, the skin. Sometimes the skin is absolutely intact, but all the deeper structures down to and exposing the rectum are torn apart, and in such instances the superficial observer will fail to discover the extent of the injury, and may even declare that no lacerations exist. In these cases I have found it best to incise the thin bridge of skin medially the whole length of the wound, which gives better access to the deeper structures for suturing. The vagina tears in one or both of the sulci, and the wound may extend up beyond the spine of the ischium, even under the broad ligament. The superficial lacerations—those of the perineal body alone—usually occur with normal labors, or forcep deliveries after the head has nearly dilated the vulva, and they go from without inward. Often the vulva is a little too small. First the skin at the posterior commissure whitens and splits, the tear running down the raphe as the head emerges, or the skin and mucous membrane having been nicked, the posterior shoulder plows through the perineal body.

Perineal tears are divided into three classes or degrees: In the first class are those where the frenulum or posterior commissure is torn to an extent not exceeding  $\frac{3}{4}$  inch toward the anus. The second class includes all other tears excepting

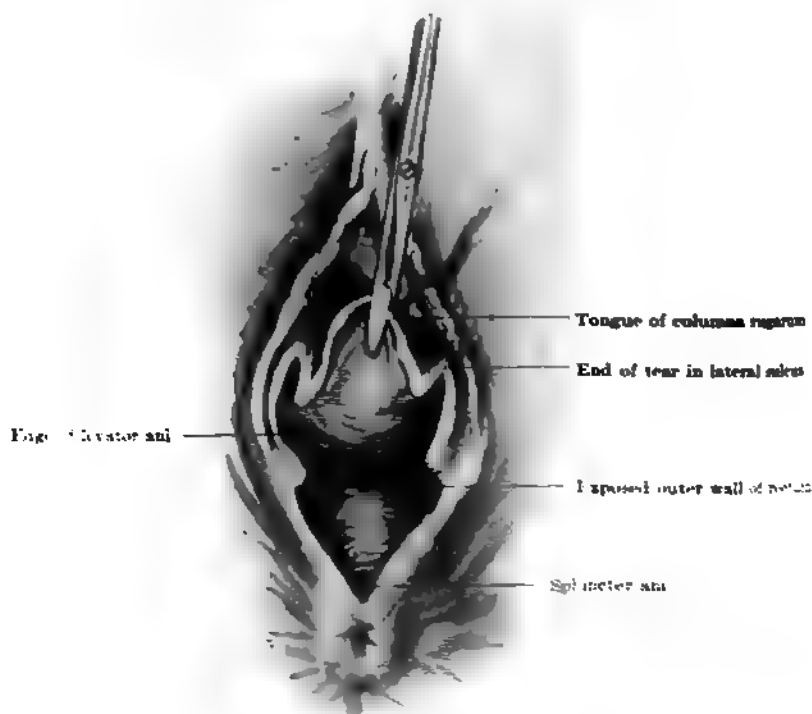


FIG. 662.—CRITICAL STRENGTH OF A SECOND-DEGREE TEAR.

This is a reproduction of a case in which the pubic arch was so narrow that the levator ani, separating the rectum from the vagina, was torn at the point of the pubic arch, and the sphincter ani. The rectum was seen through the wound, and the tear was so deep that the rectum was exposed. The tear was in the deep muscles of the perineum, and the rectum was seen through the wound. The tear was in the deep muscles of the perineum, and the rectum was seen through the wound. The tear was in the deep muscles of the perineum, and the rectum was seen through the wound.

those in which the anus and sphincter ani are involved, these being designated as of the third degree or complete lacerations. Fig. 662. This classification is unsatisfactory because it gives no idea of the depth of the injuries of the pelvic floor.

Figure 663 shows a rare form of perineal laceration, and was sketched from a case observed by the author. It is called central rupture of the perineum, and is due to a high and very resistant perineum, narrow pubic arch, or a vulva placed too far forward. The child is delivered through the rent, which may be at the side of the vulvar orifice and anus, as in the figure, or between anus and vulva, or the



FIG. 673.—PUTTING IN DEEP LEVATOR ANI SUTURES.

The torn levator ani is first repaired. With a round-pointed, full-curved needle and No. 2 twenty-day catgut the fascia over the rectum and the deeper portions of the levator ani are united. The needle passes deeply at the side and bottom of the wound, and very superficially over the rectum. With the finger in the bowel the retracted tissues are lifted up and perforations avoided. Too much tissue should not be included in this tier of sutures, since the larger part of the levator ani muscle and fascia are to be united by the deep external stitches. In very deep tears only is this buried suture necessary, but it is one of the best safeguards against future rectocele.

This suture unites the puborectal portions of the levator ani which have been stripped off the sides of the rectum; it also unites those few fibers of the levator ani which pass anterior to the rectum to meet in the apex of the centrum tendineum, including the fascia visceralis recti, and it lays the foundation for an suture of higher portions of the puborectalia. Its insertion is facilitated if the retracted tissues alongside the rectum are lifted up with an Allis forceps which grasps them under the side of the finger in the rectum.



FIG. 674.—FIRST TIER OF SUTURES.  
Shows the sides of the deep wound brought together, and the anus lifted up nearer the pubis.



FIG. 675.—SEWING THE VAGINA.

Now the mucous membrane of the vagina is brought together. By pulling up the tongue of the columnar rugarum the torn edges of the sulcus are straightened and a simple interrupted line of silk-worm-gut sutures is placed 1 cm. apart, taking care not to include the underlying perineum. Both sides are sewn in the same way. Some operators prefer catgut, but I find it is often too soon absorbed.

child may escape through the anus, tearing it in several directions. The sphincter ani and part of the rectovaginal septum may tear without extensive involvement of the perineum. In one case the head appeared at the vulva while an arm protruded from the anus; in another—a breech—one leg appeared through the anus. In all such cases it is best to perform episiotomy to prevent extensive destruction of the tissues.

**Treatment.—Preventive.**—Protection of the perineum, according to the rules laid down in the Conduct of Labor, will prevent a large number of, but not all,

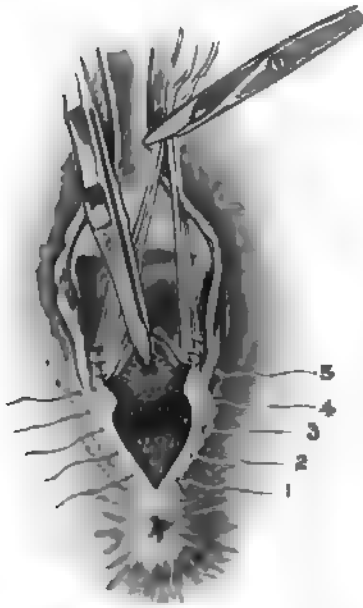


FIG. 676.—THE LAST TIER OF SUTURES READY TO TIE.

silk-worm-gut is used for the external sutures. By pulling out the side walls of the wound the needle can be passed under the levator ani muscles and the uterine septum, which may then be brought together. The needle, a large one, is inserted into the skin (the passage toward the other side of the wound under the tissue is deeply at the side then superiorly, a few inches in front of the wound and in a reverse direction in the opposite side. The point of the needle describes a path shaped like a large ellipse, or like a circle. If a finger is put in the rectum an assistant may pull on the tissues. The suture, just before it is drawn away, is put in first, passes through the skin near the levator, then under the edge of the columnar mucosa, but not the edge of the columnar mucosa.

This suture may also be passed as a figure-eight, the inner circle taking in the levator and the outer one, the uterine septum or a strip.

asserting that a tear is better. I believe that the incision should be often resorted to—that it will save the lives of many children and often preserve the sphincter ani from injury.

Slow delivery is the secret of success in preventing tears in operations. The tendency to hurry after the forceps are applied is hard to resist, and the head is usually extracted by forcibly overcoming the resistance of the pelvic floor. If continuous auscultation of the heart-tones shows that the fetus is in good condition, the forceps extraction may be extended to from twenty to fifty minutes, and in this time the perineum can be dilated safely. To counteract this desire to hurry it is my custom to place a clock in front of the operating table. Should threatening fetal or maternal danger demand haste, a deep episiotomy, the colpoperineotomy

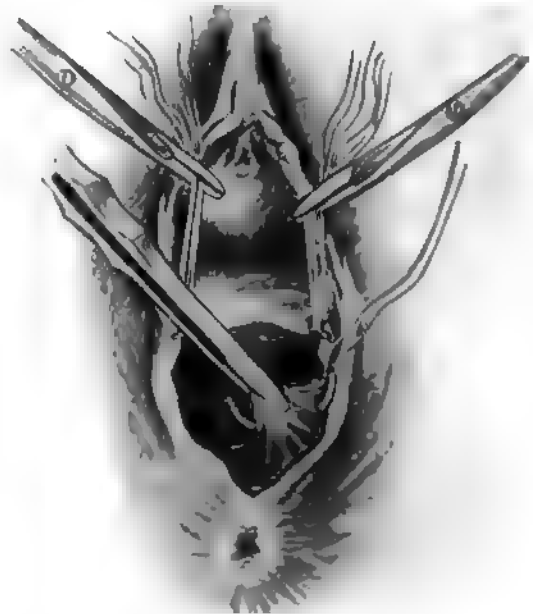


FIG. 677.—DRAWING OUT DEEP LATERAL STRUCTURES OF FLOOR, INCLUDING ANTERIOR BUNDLES OF LEVATOR ANI AND A LARGE MASS FOR SUTURE.

is preferred, a row of buried latent sutures may be used, as in Fig. 68, to bring the levator ani pulleys together. The suture is buried with superficial suture.

The latter, of silk-worm-gut, should catch a small part of perineal tissue already united for the double purpose of holding the suture, which may be absorbed too quickly, and of pulling the spaces. This suture, therefore, brings together the two layers of the levator and the uterine septum, and the cut-

pelvic floor injuries. Even episiotomy does not always suffice to overcome the disproportion between the head and the outlet. See: 318, Episiotomy. Most authors advise incisions in the perineum when it is found too firm and unelastic, but a few condemn episiotomy

Wührssen, should be performed. Manual dilatation of the perineum is also useful as an operation preparatory to forceps. In several cases where I had anticipated the necessity for rapid delivery I have used the colpeurynter to dilate the vagina and levator ani. It is a rather painful expedient, but the results are good. When the child is exceptionally large, or when the head must come through with unfavorable diameters, or very rapidly (intra-uterine asphyxia, etc.), deep episiotomy is indicated (Fig. 662). If, during delivery, spontaneous or operative, the accoucheur notices the vagina on the stretch and beginning to split, episiotomy is practiced to save the sphincter and rectum.

Perineal tears seldom bleed profusely. Occasionally an artery requires a ligature, and always firm compression with a gauze or cotton sponge will arrest the bleeding until the parts may be closed by suture. There is no question but that a deep tear of the perineum requires repair, but it may not be advisable to do it immediately after labor. If the woman is collapsed after delivery or too exhausted to undergo further operation; if there is beginning infection; if the parts are battered and bruised so that necrosis is to be feared; if there is an old laceration which will require extensive dissection for its repair—under such circumstances it may be

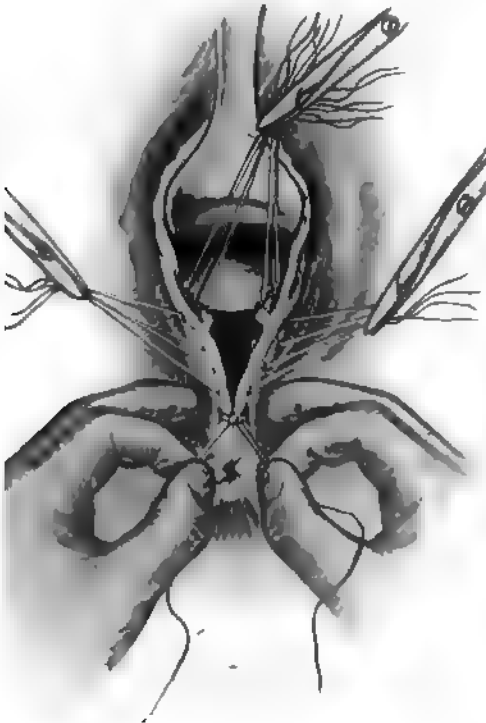


FIG. 678.—TYING.

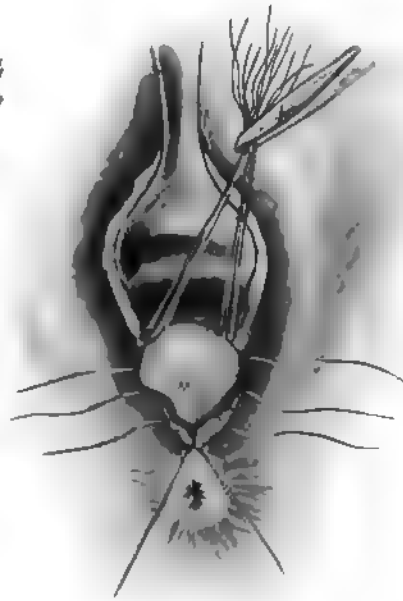


FIG. 679.—KEEPING BLOOD OUT.

to postpone the operation. My own practice in septic cases and those in which the parts are too much torn to hope for a good result is to put one or two catgut sutures in the sphincter ani and one external gut stitch to support this muscle, and leave the rest of the wound open for drainage and to allow for eventual sloughing. Several accoucheurs take the opportunity of labor to repair old lacerations, but I do not do this unless the parts are torn anew, or an incision is made. In

these cases the wound may be extended sufficiently to expose the levator ani and a typical perineoplasty performed. Hemorrhage is very free and the technical difficulties are much greater than are met a year after delivery. Clean cases, too exhausted for immediate operation, are allowed to recover and are repaired within twenty-four hours, never later. I do not approve of early secondary perineorrhaphy. If the primary operation cannot be done, the patient is instructed to return after eight or twelve months for thorough repair. Hirst performs the secondary suture on the fifth or eighth day, but my experience has been unsatisfactory. Capillary oozing is always troublesome; the tissues are brittle and stiff; it is almost impossible to work in the connective tissue and to lay bare the levator ani pillars—the crux of the operation—and healing is not so satisfactory as is desirable. Moreover, my results with primary suture are very gratifying.



FIG. 680.—OPERATION COMPLETED.

After all the sutures are tied the strands are divided into bundles,—the vaginal in one or two, the perineal in one,—and knotted together smoothly as in the figure. By tying the knot as shown, the ends will not catch in the linen nor drag in the bed-pans, and by cutting close to the knot the sharp points will be covered. Now the gauze plug is removed from the vagina, the parts cleansed, and a pad applied. As the last suture the finger is inserted into the rectum to make sure that none of the sutures has passed through the bowel. If one has must be at once removed. After operative deliveries it is my practice to catheterize the bladder to satisfy myself it has suffered no injury.

It is not advisable to place the sutures before the placenta has been delivered because: (1) The edges of the wound cannot be properly coaptated; (2) during the passage of the placenta blood is forced into the wound; (3) the stitches may tear out, and, further, should there be a postpartum hemorrhage requiring intra-uterine manipulation, it may be necessary to remove the sutures to allow the hand to be inserted. Then, too, it takes the accoucheur's attention away from the observation and conduct of the third stage of labor, which may not be done with impunity. The parturient needs the undivided attention of the accoucheur during the placental stage.

**Perineorrhaphy.**—Anesthesia is seldom necessary, since, owing to the stretching and bruising of the parts, the tissues are not very sensitive. Nervous patients require ether, but sometimes one can operate with a sort of half sleep, aided by suggestion, giving just enough ether to produce the first stage of anesthesia. The patient should lie across the bed, or, better, and to be obtained whenever



ible, on a properly prepared table, with the buttocks hanging well over the edge (Fig. 781). The same instruments are needed as for the gynecologic perineorrhaphy—needle-holders, needles, artery forceps, specula, Allis forceps, tissue forceps, artery forceps, cervix forceps, and uterine packing forceps (Fig. 664). If one has to operate without trained assistance, which is the rule in general practice, everything should be arranged within easy reach of the hand. Abundant light is essential for good work. Where the laceration is complete, the accoucheur should insist on getting sufficient help, and should, if necessary, postpone the operation until he gets it. The suture of a complete laceration of the perineum requires great



FIG. 681.—REPAIR OF EPISIOTOMY.

A superficial cut a few external sutures applied to the skin and grasping the tissues deeply at the sides bring the parts together, no vaginal sutures being required. Deeper incisions, and those involving the levator ani, are reunited like extensive lacerations. The ends of the cut muscles are brought together with deep, buried, No. 2, hardened catgut interrupted sutures.

During the application of the suture the anus and rectum are to be lifted up toward the pubis by means of a finger, in order to unite the tissues at the side and behind them. When the levator ani is torn, the rectum and anus drop toward the sacrum.

to wipe anything not sterile into the freshly broken tissues. If blood comes from above, obscuring the field, a large gauze sponge is pushed up into the anterior fornix. Do not forget to remove it afterward! A speculum held by an assistant retracts the anterior vaginal wall. A survey of the whole wound is now made, and its extent and depth are determined. Too often, in a hasty inspection, the fact that the pelvic floor muscles are torn escapes the eye, and a few stitches are

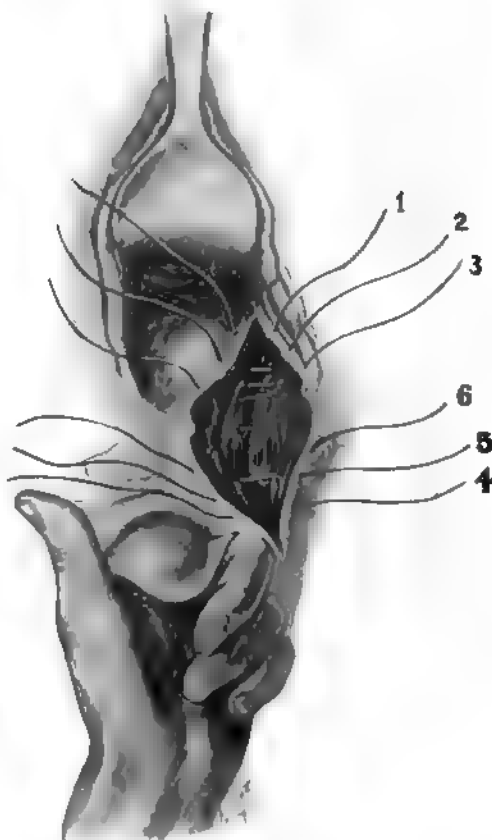


FIG. 682.—REPAIR OF EPISIOTOMY.

Levator ani has been sutured and finger in rectum lifts up this organ and brings it to a proper level for suture, also protecting it from needle. Points x-x are to be apposed.

technical skill and all the facilities of a modern operating-room if good results are to be obtained.

First the wound and adjoining surfaces are to be cleansed, care being taken to wipe anything not sterile into the freshly broken tissues. If blood comes from above, obscuring the field, a large gauze sponge is pushed up into the anterior fornix. Do not forget to remove it afterward! A speculum held by an assistant retracts the anterior vaginal wall. A survey of the whole wound is now made, and its extent and depth are determined. Too often, in a hasty inspection, the fact that the pelvic floor muscles are torn escapes the eye, and a few stitches are

put in to close the skin tear. After a few years descensus uteri shows the mistake. Suturing a complete laceration will be described because it comprises all minor degrees. Silkworm-gut is the most generally useful suture material. Except under special conditions catgut is too treacherous, both as to asepsis and to absorption.

Perineorrhaphy has four stages: (1) Uniting the torn puborectal portions of the levator ani; (2) suture of the vagina; (3) suture of the urogenital septum; (4) closing the skin. (The reader may study all steps of the operation in detail, Figs. 666-668.)

The after-care does not vary from that usually pursued in puerperæ. The legs need not be bound together unless the woman is delirious. When the laceration has been complete, special instructions are to be given the nurse regarding the bowels. I do not give opium to bind up the bowels, but order a semisolid diet.



FIG. 668. Sphincter of External Sphincter.

The patient is to be kept on a diet of soft food, and the bowels are to be kept open by the use of laxatives. The patient is to be kept in a comfortable position, and the bowels are to be kept open by the use of laxatives.

free from cellulose, and large quantities of water. After the third day liq. petroleum 3j A.M. and P.M. is given. On the tenth day a dose of castor oil is ordered and at the same time the nurse injects, with a soft rectal tube, 8 ounces of sterilized warm olive oil into the bowels to be retained. The patient is instructed not to strain when the bowels are about to move. After the first movement a daily laxative may be administered unless the liquid petroleum suffices. If the accoucheur has to renew any case, he should not risk the success of his operation in incompetent hands, but should refer it to the physician himself. The vulvar pad should be changed daily, and the vulva so that the faces issuing from the anus may not disturb the sutures. I have known fatal infection to result from this. The spots are to be treated daily. A small amount of cutting through may be neglected, or the spots touched with tincture of iodine. Deeply cutting stitches

had best be removed. Marked swelling of the vulva usually subsides under a warm moist application of weak lead-water or acetate of aluminum solution (sterilized).

The stitches are removed on the tenth to the fourteenth day, being left longer on the larger lacerations. If infection develops, the safest course is to remove the stitches and open up the wound widely for drainage. Occasionally excessive growth of granulation tissue occurs at the margins of the wounds, and after several weeks the patient returns, complaining of pain, burning in urination, and constant irritating discharge. Sometimes, especially after forceps deliveries, there is a periostitis rami pubis, which causes difficulty in locomotion. The granulomata are to be cauterized away with a nitrate of silver stick. Hot applications will help heal the periostitis.

### LESIONS OF THE VAGINA

Rarely, in spontaneous labor, is the vagina torn, except in association with perineal lacerations, already considered.

**Causation.**—If the vagina is congenitally too small (infantile) or rigid (old primiparæ), or scarred by disease (gonorrhea, etc.) or previous lacerations or operations, or radium or x-ray treatments, it may tear during ordinary labor, and certainly will give way during artificial delivery. Precipitate labors occasionally, but forceps and rapid breech extractions particularly, show vaginal tears. Twisting the head in the pelvis by the forceps—so-called “rotation”—may split the canal the whole length and open up the perivaginal spaces down to the bone. Hemorrhage in such cases is usually very profuse, may tax the best skill, and may even be fatal. Tears of the posterior vaginal wall are usually due to perforation by the tip of the forceps blade, but may be spontaneous and may even go through into the rectum. Perforating tears may be produced by friction of the vagina between the head and prominent bony points, as the spines of the ischia, the promontory of the sacrum, or an exostosis on the posterior surface of the pubis, or from stone in the bladder. The forceps also may be pushed through the vaginal wall. Anterior tears may result from traumatism in delivery, from the operation of hebstectomy, when the vagina may communicate with the pubic wound, and even the bladder become open. During delivery after craniotomy sharp spiculæ of bone, if unprotected, may penetrate the vaginal wall, or even open up the bladder.

Pressure necrosis of the vagina may occur, as was described under Contracted Pelvis, and if large portions of the mucous membrane slough out, lochiocolpos may result and obstruction from stenosis of the passage in a subsequent delivery.

**Description.**—Usually the tears are longitudinal, and occupy the sulci alongside the anterior or posterior columna. In the former case the bladder, in the latter the rectum, is exposed. Anterior lacerations are often accompanied by a tearing of the levator ani pillars from their pubic attachments. The edges of the tear are usually straight, except when necrosis occurs, and the connective tissue is then widely opened up. In the fornices the tears are generally transverse, unless they communicate with cervix tears. Hemorrhage is free, depending on the location. Sometimes the tear extends more or less circularly around the vagina, near the cervix, and opens up the peritoneal cavity. This is a serious accident, is called *claporrhæxis*, is closely akin to rupture of the uterus, and will be considered together with that subject.

Vaginal tears may be the port of entry for infection, with paravaginal abscess or even general septicemia, both of which are rare unless the case is otherwise infected. As a rule, the lacerations of the upper third of the vagina heal without treatment. Lacerations of the lower half of the vagina usually extend into the musculature of the pelvic floor, and should be treated as such, because, if not, prolapsus uteri will follow sooner or later.

### LESIONS OF PELVIC CONNECTIVE TISSUE

Overstretching of the anterior wall of the vagina, combined with tearing the fascia between the bladder and the vagina, is responsible for the majority of cases of cystocele. In many cases the urethra and base of the bladder are pulled down and off from their attachments to the posterior wall of the pubis. Overstretching of the pelvic connective tissue, downward dislocation of the vagina from its connective-tissue supports, are causative of many cases of procidentia. The vagina may be actually torn away from its pelvic attachments, which occurs invariably when forceps are applied, or breech extraction made before the cervix is completely dilated, and before it, together with the upper fourth of the vagina, is drawn up out of the pelvis. If the accoucheur wishes to verify this statement



FIG. 684.—SHOWING HOW THE HEAD, DRAGGED THROUGH AN UNPREPARED PARTURIENT CANAL, PULLS DOWN THE PARTS, SOMETIMES ACTUALLY AVULSING THEM FROM THEIR BONY ATTACHMENTS.  
Arrows show direction of the rupture

let him pull the head down into the pelvis before the cervix has retracted and what a large pad of tissue is dragged down into the inlet before the head. FIGS. 684 and 685 show the differences between such a condition and one where the head has been drawn up into the abdomen. To a less extent the same condition is present when a woman bears down before the cervix has retracted above the pelvic inlet. The frequency of procidentia after forceps deliveries and breech extractions before complete dilatation is thus explained. The sacro-uterine ligaments are often stretched and overstretched. This allows the cervix to sag down, the fundus now turns forward, favoring the prolapse. After such destruction of the connective tissue the cervix disappears from the pelvis, and this should also be considered in the study of the causes of prolapse. Women who have their first children late in life are more predisposed to procidentia than young primiparae, because their connective tissue is not so elastic, tearing, rather than stretching.

Labor in elderly primiparæ is often, not always, characterized by delay due rigid soft parts. While the dangers are exaggerated in the public mind I have ind that lacerations are more frequent and extensive, faults of mechanism are

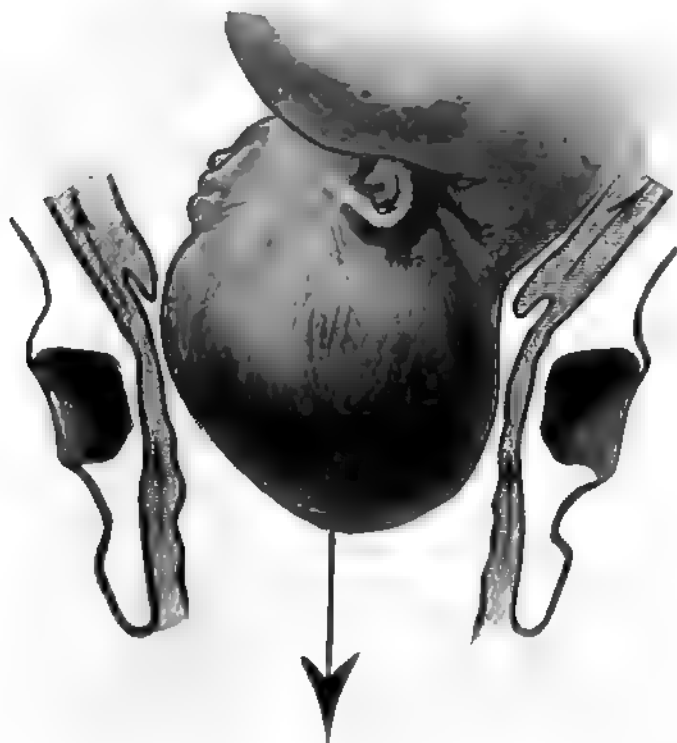


FIG. 685.—SHOWING HOW THE HEAD COMES THROUGH A PROPERLY PREPARED PARTURIENT CANAL. Arrows indicate direction of the tissues retracting above the advancing head.

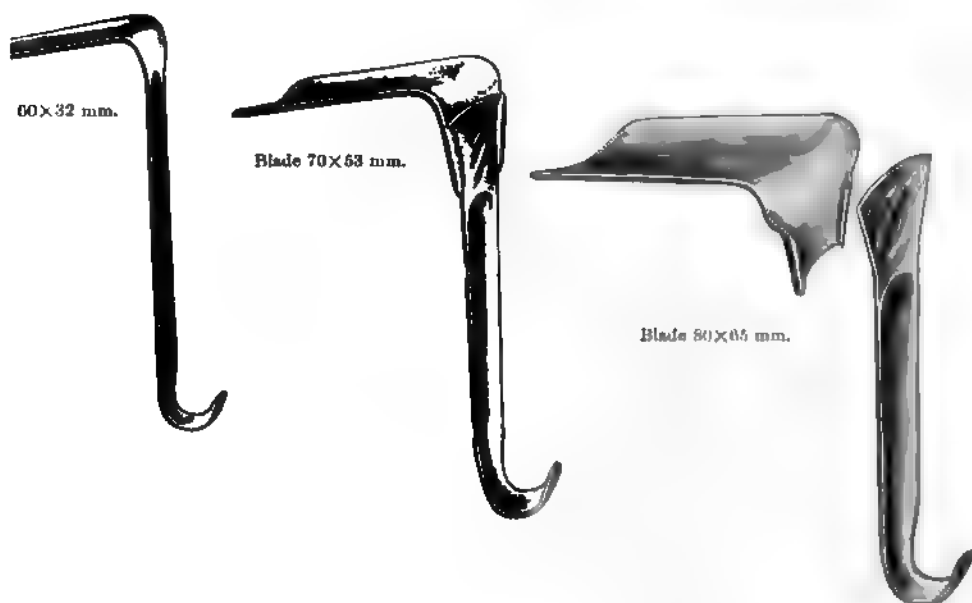


FIG. 686.—AUTHOR'S OBSTETRIC SPECULA.

commoner, prolonging labor, the infant mortality is higher, and the maternal morbidity also increased. (See page 666 and Spain for literature.)

**Prognosis.**—Perineal and vaginal lacerations are not serious if properly treated. Infection is the worst danger. Hemorrhage may be fatal if large veins or arteries are involved. In placenta prævia cervicovaginal tears are often fatal. Scar formation may later deform and displace the vagina and neighboring hollow organs, and also cause strictura recti. Incontinence of urine may be thus produced from scars pulling open the neck of the bladder, or in making diverticulæ of the urethra with infection and abscess. The uterus may be dislocated in all directions. In one case I saw the cervix pulled down to the introitus. Subsequent labors may be rendered so difficult by these deforming and obstructive cicatrices that even cesarean section may be required.

**Treatment.**—By the employment of the colpeurynter to dilate rigid vaginas,

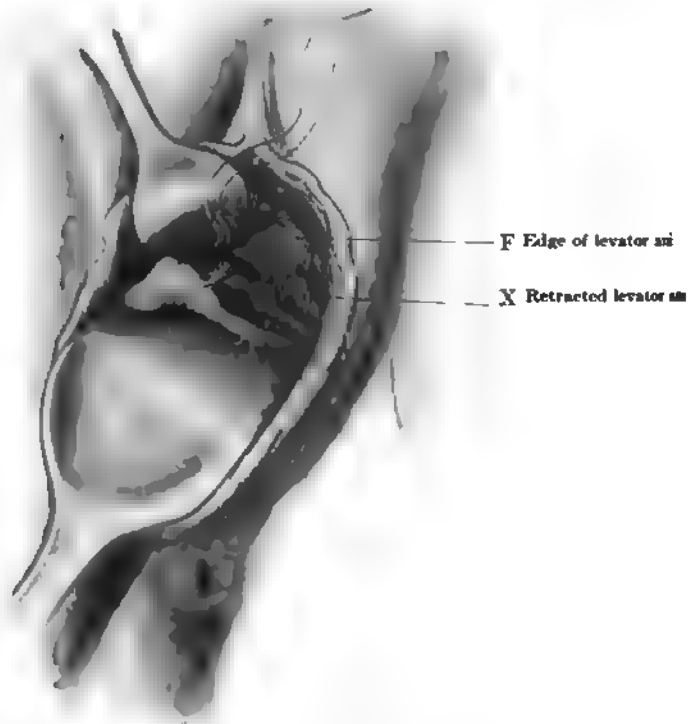


FIG. 687.—REPAIR OF LACERATION AT BASE AND SIDE OF BLADDER.

A broad, short speculum retracts the perineum, a pad holds the cervix out of the way and absorbs the excess blood, a narrow speculum lifts up the bladder. Thus exposed, the wound is visible, but not comfortably accessible. The needle passes through the posterior lip of the wound first, then across the base of the bladder, avoiding the ureters and out through the upper lip of the wound, the point striking the speculum and sliding over it into the base of the assistant's artery forceps. If it is possible to pick up the torn levator ani pillar at X and attach it to the perineum or obturator fascia at F, it should be attempted. There are large veins at this point. Occasionally it may be easy to engage the structures in the needle by reversing the process as shown in the drawing.

or those which are to be exposed to injury from rapid stretching, many tears may be avoided. If the laceration of the anterior and lateral walls of the vagina is unavoidable and the levator ani is endangered, it is better to make a deep incision into this muscle in its median portion, than to allow it to be pulled off the ramus pubis. Tears in the upper third of the vagina require no treatment unless they bleed. A few stitches usually will stop the hemorrhage, but sometimes the flow is so profuse that one cannot see the wound. Here uterovaginal tamponade is indicated instead of the suture. Next day an attempt at repair may be made, or the

operation postponed for six months. If free bleeding obstructs the view, rendering the operation technically difficult, it may be possible to tampon that part of the wound from which the hemorrhage comes while the other part is being sutured, or the suture may be passed entirely under the guidance of the finger. After suturing, it is best to do a uterovaginal tamponade to prevent hematoma formation in the loose paravaginal tissues. Tears around the base of the bladder require accurate repair—even then cystocele may not always be prevented. If the puborectal portions of the levator ani are torn from the posterior surface of the pubis, this fact may be discovered by opening up the rent widely to view. I have tried to reunite the muscle to the obturator fascia, having failed to attach it to the bone, and with fair success. A broad speculum, very good light, sharply curved needles, and several assistants are needed for good repair work in the vagina. (Fig. 687).

### HEMATOMA VULVÆ ET VAGINÆ

Blood-vessels, particularly the veins, in the pelvis may burst during pregnancy, labor, or postpartum, and a blood tumor or "thrombus" form in the loose connective tissue. Hematomata have been found under the skin of the vulva, around the vagina, under the broad ligaments, in the broad ligaments, and they show a tendency to enlarge, following the lines of cleavage of the connective-tissue layers or fasciæ. If below the levator ani and deep pelvic fascia, they distend the perineum and dislocate the rectum and anus, forming tumors sometimes as large as a cocoanut. If around the vagina, they may fill up the pelvis, forcing the vagina to the side and closing it, causing obstruction to delivery or to the flow of the lochia. They may be pedunculated in the vagina, and may occur in a septum vaginæ. If at the base of the broad ligaments, they may extend up into the false pelvis under Poupert's ligament, or, if behind, they may dissect up to the kidney back of the peritoneum. In the case from which Fig. 688 was taken the blood tumor was so extensive that the woman nearly died of anemia—the vagina was closed, the vulva displaced downward, and the cavity formed by the blood extended up out of the pelvis to a level with the anterior superior spine of the ilium. While the hematoma begins to form at once, it requires a few hours for its presence to become manifest, and usually within ten hours the blood mass is fully developed. Rueff, in 1554, reported the first case of hematoma.

*Etiology.*—The bursting of the vessel may be caused by injury—the traumatism of spontaneous labor—or by the forceps, etc. Pressure necrosis explains the cases of formation of hematoma late in the puerperium—on the third, eleventh, and twenty-first days, as reported. Varices are said not to favor hematomata.

Rough uterine massage in the treatment of postpartum hemorrhage may cause small hematomata in the subperitoneal connective tissue and in the broad ligaments, but perhaps in the fatal cases, where such findings were made, the woman died of a hemophilic diathesis and the latter caused the blood extravasations. In one of my cases, during the treatment of placenta prævia, a tumor developed in the perivaginal connective tissue, extending from the vulva to the uterus, which was taken to be a hematoma, but upon cutting into it with the expectation of turning out a clot, none was found, the tissues being simply infiltrated with blood. Hematomata are rare, about 1 to 4000 labors, but statistics vary. In an experience comprising the pathologic work of over 30,000 routine cases, only five cases of large hematomata have come under my notice. Small hematomata are not exceedingly rare, and their formation may sometimes be observed when a vein is pricked while repairing the torn perineum.

*Symptoms.*—Intense pain is the most prominent symptom, and the intelligent patient will describe the tearing open of the tissues and the intolerable pressure on the rectum and bladder. Sometimes the skin or the vagina covering the tumor bursts, and the patient may bleed to death. If the hematoma burrows a great distance,





plied. To procure a bloodless field while operating the Momburg belt or an *arteria* compressor may be used, this only in critical cases. If it is possible to wait twenty-four to forty-eight hours before performing this operation to allow firm thrombosis in the torn vessels, the possibility of secondary hemorrhage at the operation is avoided. Small hematomata may be left to be absorbed, but all are to be removed at the first sign of infection.

### LESIONS OF THE CERVIX

Every labor is attended by more or less injury to the cervix, since even a normal *pervius* cannot stand the enormous radial dilatation required for the passage of the child. Large tears of the cervix result from—(1) Too rapid or too forceful dilatation by the powers of labor (precipitate births) or by the accoucheur, with his operative deliveries before the os is completely dilated; (2) from disease of the cervix, atonic rigidity, old primiparity, healed ulcers and scars from former deliveries or operations, cancer, syphilitic and gonorrheal induration, etc.; (3) too large child or congenital smallness of the cervix. Most of the tears are of the first class and are due to violence. Every case of accouchement forcè and every manual or instrumental dilatation of the cervix is attended by more or less numerous and deep lacerations. If the operation is performed before the cervix is completely effaced, serious or even fatal injuries may result.

The lesion may be a small nick in the mucosa, or a deep rent extending through the cervix, the vaginal vault, the parametrium, even to the brim of the pelvis, and up under the peritoneum of the broad ligaments, or even into the peritoneal cavity—with all grades between. The large rents are treated under the subject of Rupture of the Uterus. Lateral or bilateral lacerations are most commonly found, owing to the peculiarities of fetal development, but radial tears, from one to five in number, may be observed, and they occupy any part of the cervix. Sometimes a portion of the cervix is dragged off the uterine body at the vagino-uterine junction, or the whole cervix may thus be amputated and cast off as a ring of tissue. The circular amputation of the cervix may be produced by trying to draw a colpeurynter through the unprepared cervix, or the uterus may force the head down, carrying the cervix before it. The resulting scar nearly always closes the uterus. The anterior lip of the cervix may be caught between the head and the pubis and be squeezed off, or suffer so much compression that it becomes necrotic.

Cervix tears are usually not discovered until after the child is delivered, when the hemorrhage begins. Bleeding is not constant. Unless a large branch of the uterine artery or a vein is torn across, there is none of any moment. In placenta *prævia* cervix tears usually bleed furiously, the immensely dilated veins being opened by even a superficial lesion.

**Prognosis.**—Small tears of the cervix, unless infected, heal without trouble, but larger tears always leave deforming scars, leading to ectropion, catarrh, and, some say, to carcinoma. Perforating tears are often fatal. Chronic metritis undoubtedly follows large cervix tears, and, since they are always associated with injury of the pelvic connective tissue, *descensus uteri* often results.

**Treatment.**—In spontaneous deliveries it is not advisable to pass the finger into the uterus in search of injuries unless bleeding or other indication (for example, collapse, precipitate birth) demands it. Many advocate the search for and the immediate repair of all lesions as a routine. In hospitals with good technic such a course might be followed, but in the home it is generally impracticable. After forceps and other operative deliveries, and always when injury is suspected, a complete digital, and, if need be, a specular, examination is to be made. Whether or not to sew up the tear in such cases depends on circumstances. Where infection is present or probable, the tear is not sutured unless it bleeds and packing will not stop it. If the operator has good help, the lacerations are repaired in all clean operative cases, whether or not there is bleeding. Under unfavorable operating-

room conditions the woman is safer with the cervix open to drain, and repair may be made later. Hirst and a few others recommend secondary suture on the fifth or sixth day of the puerperium, but the author does not advise it, for reasons already given under Perineorrhaphy. Titian Coffey repairs all cervixes on the tenth day.

Fig. 689 shows a typical cervical laceration extending to the fornix vaginalis.

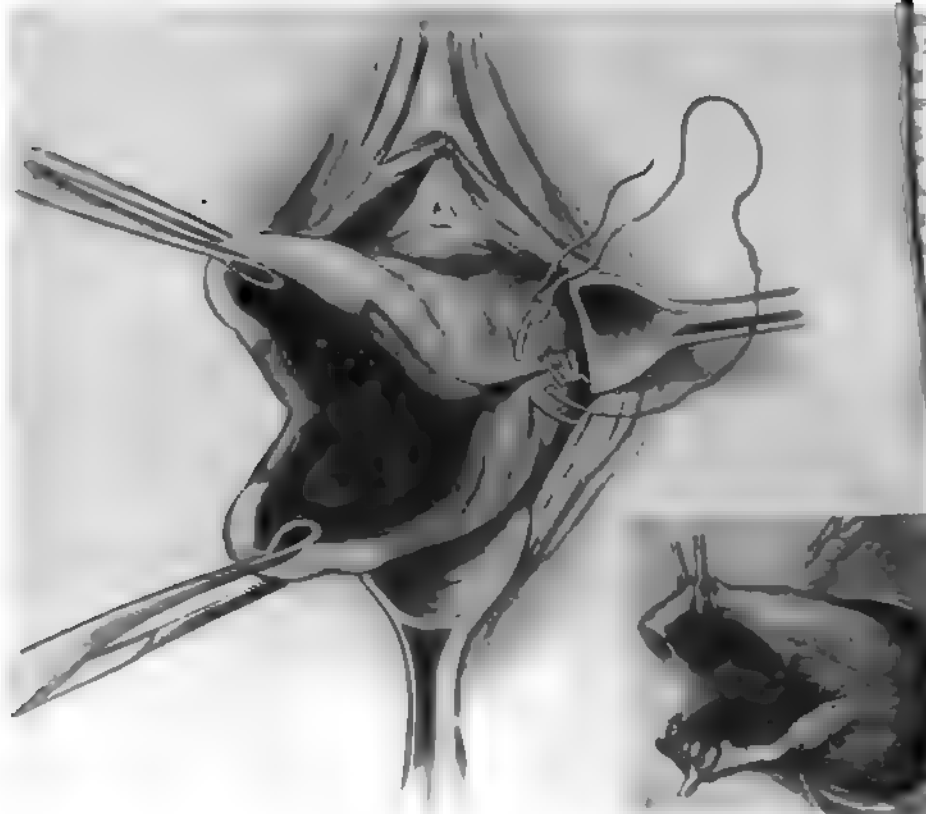


FIG. 689.

FIG. 689a.

FIG. 689. — SEWING A LACERATED CERVIX WITH CONTINUOUS SUTURE OF FORTY-DAY CATGUT. The needle goes down to, but not through, the mucosa. In favorable cases a row of buried No. 1 gut may be sown as in Fig. 689a.

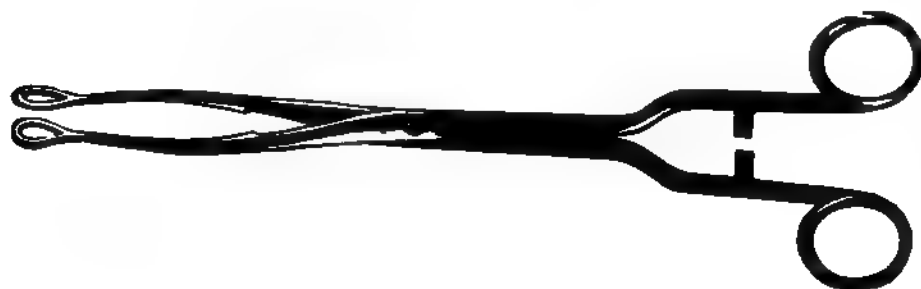


FIG. 690 — ARTHUR'S CERVIX FORCEPS.

Hold mucosa securely without tearing torn, and present no points to puncture rubber gloves.

the result of a forceps delivery through a narrow os. It was bleeding moderately and was easily sewed, as shown. By means of the vulsellum forceps or the cervix forceps shown in Fig. 690 the two lips of the uterus are drawn down to the vulva and become readily accessible for suture. (See Postpartum Hemorrhage.)

When bleeding is profuse, it is not so easy to sew the cervix, because it is hidden in a pool of blood. A bullet forceps may be clamped on the base of the broad ligament, as advised by Henkel for temporary hemostasis. Another plan is to pass the needle from the inside of the cervix under the guidance of the finger, and tie the suture inside the uterus. The balance of the stitches are put in from the outside of the cervix, the most important being the uppermost one, near the introitus vaginæ, since it is intended to stop the hemorrhage which comes from the large vessels here. Continued suture is used if haste is demanded, otherwise interrupted No. 2 forty-day catgut. Since the ureter is close by, the needle in the first suture must be passed in a direction nearly parallel to the uterine body. The others are transverse and pass to, but not through, the mucosa. They may be drawn fairly tight, because the cervix rapidly shrinks postpartum. The Momburg belt has been used in urgent cases to stop the bleeding until the wound could be sutured. Should infection begin in the puerperium, the stitches are to be at once removed and drainage provided, because otherwise the parametria will be rapidly involved, and even fatal septicemia result. Douches are contraindicated.

### RUPTURA UTERI

This fearful accident occurs oftener than is generally believed, and few emergencies in all medicine require so much of what makes a great surgeon as does this one. The uterus may rupture during pregnancy and during labor, and since the latter is more common, it will be first considered.

**During Labor.**—*Etiology.*—Ruptures of the uterus are divided into two classes, spontaneous and violent or traumatic. Spontaneous ruptures are those which occur as the result of the natural forces of labor, or because the muscle of the uterus is pathologically altered, so that it bursts from the ordinary processes of labor or distention. Violent or traumatic ruptures are those which result from injury, either from the hand or instrument of the attendant or by external agencies. Often the uterine muscle is so thinned by the action of labor that it bursts with only a little stimulation. The causes of actual rupture may be divided into predisposing and exciting. Predisposing causes are, first, those conditions which produce a weakening of the uterine wall, as fatty or hyaline degeneration of the muscle (Figs. 126 and 127); syphilis; pressure necrosis during prolonged labor; scars from previous operations (cesarean section, salpingectomy with excision of uterine cornu, curetage); scars from previous rupture, from puerperal septic processes, and old inflammations; thinned spots from the removal of adherent placenta in previous labors, myomoids, and other neoplasms; adherent uterus; overdistention of part of uterus; congenitally undeveloped uterus; pregnancy in a horn; interstitial pregnancy; attachment of the placenta into the uterine musculature, especially if it happens to be attached over a thinned or diseased portion; placenta prævia; edema of the lower uterine segment the result of prolonged labor; polyhydramnion. The second group of predisposing causes comprises all the mechanical factors which stop the advance of the child through the birth-canal, as contracted pelvis of all kinds; overgrown uterus; deformities of the child which increase its size, especially hydrocephalus; malpresentations (shoulder, face, and brow, anterior and posterior parietal bone); malpositions, as occipitoposteriors; delayed rotation of the head; obstruction of the birth parts, as tumors blocking the pelvis, atresia cervicis or vaginæ, rigid perineum; and incarceration of the cervix between the presenting part and the pelvic brim. A distended and indolent abdomen, by putting the posterior uterovaginal wall on the stretch, creates a condition favorable to rupture, the resulting lesion being called kolpoporosis, or kolporrhexis. Unless the natural powers can overcome these obstructions with a moderate amount of effort, something has to give way, and the weakest point the most overstretched point is the site of rupture.

Exciting causes of the rupture are the contractions of the uterus and mechanical insult or violence. To understand the mechanism of spontaneous rupture it is

necessary to refer to the normal mechanism of labor and the formation of the parturient canal. We are indebted to Michaelis, Bandl, and Freund for the foundation of our knowledge of this subject. Throughout labor the fundus of the uterus contracts, while the isthmus and cervix are dilated from above downward, the uterus being differentiated into an upper zone of contracting, and a lower of dilating fibers. The fibers of the isthmus uteri and cervix are drawn upward into the body of the uterus, and, at the junction of the contractile with the dilating portion, is a well-defined ring of muscle which Bandl called the *contraction ring*. The mesometrial uterine ligaments fix the cervix in the pelvis behind, the bases of the broad ligaments fix it at the sides, and the connective tissue at the base of the bladder anchors it in front.



FIG. 691.—EXCESSIVE DRAWING OF LOWER UTERINE SEGMENT. BROW PRESENTATION. Arrows indicate direction of tension. Note gaitropic action of round ligaments.

front, all of which connective tissue and partly muscular support prevent too great upward retraction of the cervix. An additional and important factor in the mechanism of rupture is the fixation of the cervix by the head, squeezing it against the bony pelvis. This is particularly likely to happen if the bag of waters ruptures before the cervix is dilated and retracted above the presenting part. The fundus uteri is held down and prevented from pulling too far up over the child, and away from the pelvis, by the gaitropic-like action of the round ligaments (Fig. 169) and the pressure of the abdominal wall. It is easy to see that if the child may not advance along the birth-canal, the continued action of the uterus will result in the contracting portion having forced nearly the whole child down into the dilating portions of the lower uterine segment and cervix, and itself having retracted above the child.

as the round ligaments and the abdominal wall would permit. Its wall may have a thickness of only a few millimeters, while the fundus is 4 cm. thick. Fig. 691 shows the condition. Sometimes the cervix is more or less fixed at the inlet and cannot wholly retract with the lower uterine segment, and, therefore, the latter is drawn out in the length and may tear transversely (Fig. 692). Since the dilatation of the lower uterine segment is never symmetric, owing to the obliquity of the uterus, the irregularity of the body contained therein, pendulous abdomen, &c., some portion of it is stretched more than the rest, and here the rupture occurs. As a rule, first the muscle-fibers separate and tear, then the mucous membrane gives way, and finally the peritoneal covering of the uterus. I have on several occasions felt this occurrence under my hand. If the cervix has already been dilated and fully taken up to form part of the parturient canal, it cannot be fixed below, but retracts upward, with the lower uterine segment, and the full force of this retraction is distributed along the wall of the parturient canal from the contrac-

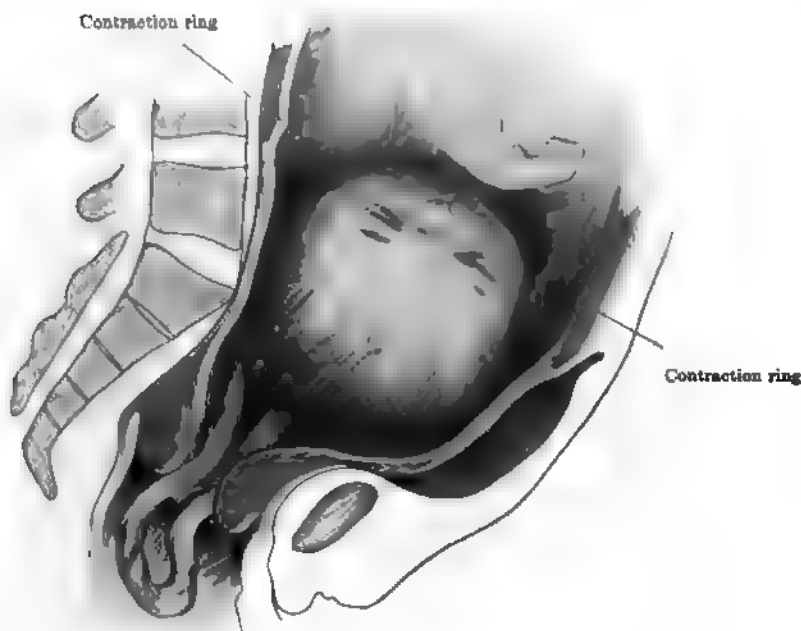


FIG. 692.—INCARCERATION OF THE CERVIX BETWEEN HEAD AND PELVIS. CERVIX SWOLLEN. Rupture would take place just above it. Case of Mrs. G.

tion ring down the vagina to the attachments of the latter onto the pelvic floor. If the stretching of this canal is too great, the rupture will occur at its weakest spot, and this is usually the posterior fornix of the vagina. Indeed, in cases of shoulder presentation, immense hydrocephalus, pendulous abdomen, where the presenting part cannot imprison the cervix against the pelvis, we find such ruptures of the vagina or kolpoporrhesis (Hugenberg) (Fig. 693).

Ruptures in the lower uterine segment are usually longitudinal or oblique; those in the fornix vaginae, usually transverse or even completely circular. The normal contractions of the uterus alone may cause a rupture if the wall is diseased, and in the presence of mechanical obstruction even a normal muscle may burst if the pains are strong. The deadly effects of pituitrin must here be mentioned. In the olden time ergot was the offender.

Violent or traumatic ruptures have no special mechanism, but, as a rule, the fundus is already drawn up, and the lower segment and vagina thinned out as above described at the time the causative injury is inflicted, and on this account

the shape and location of the tear are very similar to the spontaneous ones. The forceps blade or the cranioclast may be pushed through the wall, or grasp a part of the musculature and crush it. Traction with the forceps pulls the cervix and a transverse split occurs in the lower uterine segment, already stretched length to the point of bursting. The hand introduced alongside the child can in the ad maxima distended, lower segment may cause the tear; or the attendant may turn the child by bringing the trunk down into the pelvis alongside the head, too great a strain on this portion of the uterus; or the hand pushes the uterus away from the vagina, and the rupture occurs at the junction of the latter with the cervix, or finally too rapid delivery through an unprepared cervix simply burrows through the narrow canal. Instrumental injuries usually are found in the neighborhood of the fornix vaginae and the cervix; the others usually in the overdistended uterine segment, and it is evident that the operator only completed a tear which was already being prepared for or just beginning.

**Frequency.**—Freund, from the collected reports of 17 authors, found 2114 cases of rupture, but the individual reports varied from 1 to 234 to 1.

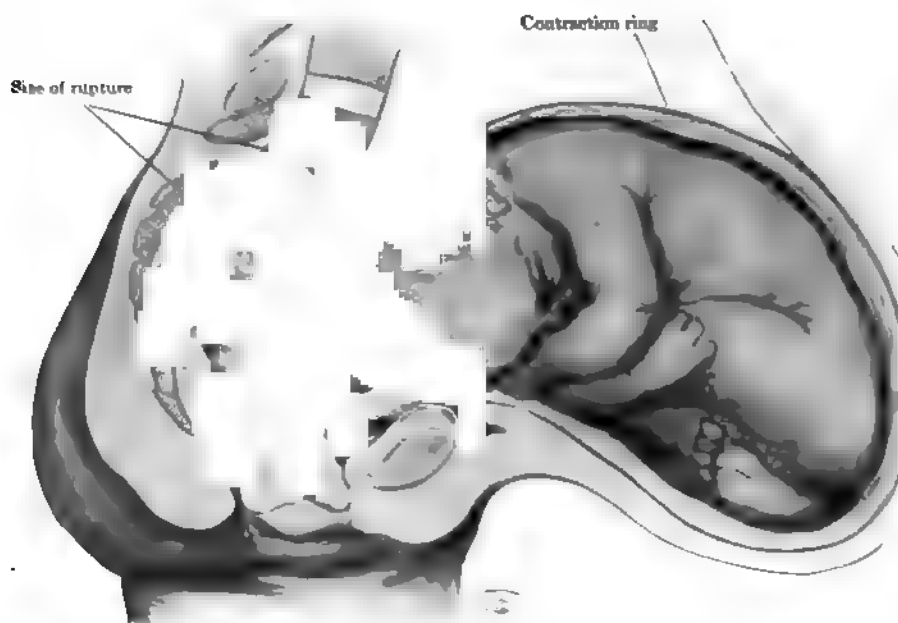


FIG. 651.—RUPTURE OF UTERUS.  
Mrs. Y. Seven Months Pregnant. Hospital, Germany.

cases. These statistics, with few exceptions, came from hospitals, and in rupture cases going to the hospitals, the figures are large.

Multiple are often met, injured than primiparae, although it might be often said that the danger increases with the number of children. This is due to structural changes, the weakness of the muscular fibers, the scars and lacerations the residues from previous labor. In primiparae the perforating tears are commoner than the type of the ruptures. The years of greatest frequency are in the thirty and forty. Women with loose abdominal walls are especially and fat women seem to be especially predisposed.

**Pathology.** Ruptures are of two general classes—the complete, with external laceration, and the incomplete, when the rupture is internal and the peritoneum remains intact.

Fig. 652 shows an incomplete rupture with a subperitoneal hematoma.

Fig. 694a the same case after the thin peritoneal covering of the blood tumor had given way because of the restless tossing of the patient, and a fatal hemorrhage into the peritoneal cavity had ensued. Note how the peritoneum has been stripped off the uterus. In violent or traumatic ruptures the cervix is oftenest split in the length, or at least the rupture is usually longitudinal; in spontaneous ruptures the tear is usually more or less oblique and often transverse, while it may be L or V shaped. The anterior uterine wall is oftenest involved, then the sides, the left more commonly, and least frequently the posterior wall. Double tears, one on either side of the uterus, are on record. Rupture of the vagina—kolpoporrhesis—rare, and oftenest the posterior fornix is torn, while the anterior and lateral walls suffer less. According to Stschoikin, there were 36 posterior, 24 anterior, 8 lateral, and 8 completely circular tears in 74 cases. Involvement of the bladder is a very serious complication, with 87 per cent. mortality (Klien), and is, fortunately, rare.

The edges of the tear are saggulated and ragged. If the broad ligaments are opened up, the veins and arteries can be felt traversing the connective-tissue spaces, which are filled with blood, and sometimes with air or gases of decomposition (emphysema). The hemorrhage comes from the large venous plexuses, from the uterine arteries and its large branches, especially the uterovaginal. The hematoma

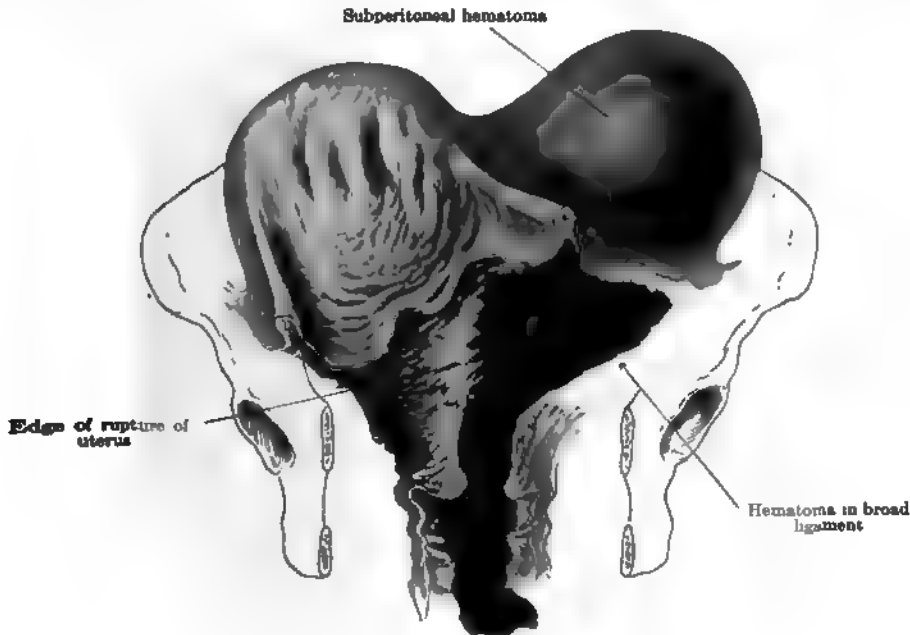


FIG. 694.—DIAGRAM OF UTERINE RUPTURE. BROAD LIGAMENT UNFOLDED AND DISTENDED BY IMMENSE HEMATOMA.

may burrow in the connective tissue, far away from the site of rupture, even to the kidneys. If the tear is behind the broad ligaments, the bleeding may be small, but if it is through the bases of the broad ligaments or involves the site of the placenta, the woman may die in a few minutes from the sudden immense loss of blood. In my cases the loss of blood was greatest in the incomplete ruptures, while the shock was most evident with the complete ones. Urine, meconium, lanugo, vernix caseosa, and liquor amnii may be found in the peritoneal cavity.

Usually, at the height of a pain, the thinned portion of the uterus gives way, but sometimes the separation of the fibers is gradual, and the rupture is completed without producing alarming symptoms (latent rupture). Only after peritonitis sets in is the condition recognized, or, indeed, at a subsequent labor, when the uterus ruptures again at the site of the previous scar. The point which is most

can be done to save the woman, it must be done at once. The findings in a case of rupture are—(1) A restless, excited, anxious patient, high pulse (90 to 110), rapid respiration, temperature  $99.6^{\circ}$  to  $100.4^{\circ}$  F., and, if infection is beginning,  $103^{\circ}$  F.; (2) *strong uterine contractions without proportionate advance of the fetal part*; (3) the uterus hard and drawn up over the child, which lies in the lower uterine segment (Fig. 697). The fundus is thick and the lower uterine segment soft; it balloons out during the pains, allowing the fetal body to be outlined with startling distinctness. The latter seems to lie under the skin. This is possible under anesthesia—the exquisite tenderness prevents it otherwise; (4) a constriction is visible and palpable, running obliquely across the belly, higher on the right than on the left, at the time of the greatest stretching—the contraction ring (Fig. 697). It may rise as high as the navel or higher, and the distance from the pubis may be used to judge of the degree of thinning and stretching of the lower uterine segment; (5) the

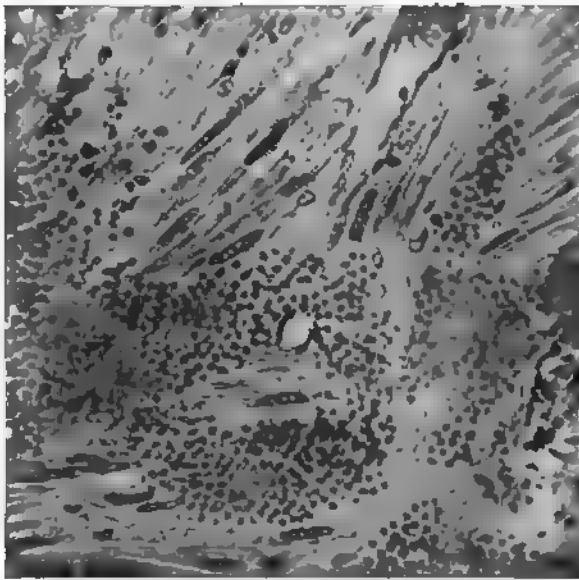


FIG. 696a.—SECTION OF RUPTURED UTERUS.  
High power. Shows the torn muscular fibers.

ligaments are inserted high on the uterus, are tender, hard, and wiry, and particularly the one on the side which is going to burst may be tense and taut, like a violin string; (Fig. 697); (6) the uterus is oblique; (7) the bladder is drawn up high; (8) a marked abdominal tenderness is present, but the lower uterine segment is so sensitive that the woman will hardly allow it to be touched; (9) internal examination reveals the cervix, either imprisoned in the pelvis and swollen, black and blue, or protruding up out of the pelvis with the vagina on the stretch, taut around the prepuce, and hot, reddened, and dry.

These findings on the direct examination will enable every accoucheur to diagnose the danger which threatens the woman in time to institute proper treatment. Unfortunately, in the latent ruptures they may be absent or veiled.

**Actual Rupture.**—The symptoms of the actual tearing of the uterus and the shock and anemia which follow will almost always be sufficient to make the diagnosis, but an examination of the patient must be made to confirm it. The findings in cases of rupture of the uterus vary, of course, with the time in labor when it occurs, and whether or not the child is in the uterus or in the belly when the diagnosis is made. They are: (1) A collapsed patient with all the signs of



anemia and of shock; (2) uterine action stopped or very weak; (3) external hemorrhage, mild or severe, rarely absent; (4) abdominally, the child can be felt with surprising distinctness, lying right under the belly-wall, while the empty uterus is pushed to one side, or behind, where it is not palpable. If the child has partly escaped, the uterine tumor is heart shaped. Dulness in the flanks from free blood is very rarely determinable. Tenderness may make the abdominal examination nugatory; (5) externally the hematoma may be felt, or emphysematous crackling; (6) internally, the ragged rent may be palpable, and intestines or omentum may fall



FIG. 197. ABDOMINAL FINDINGS IN A CASE OF THREATENED RUPTURE UTERI.

Mrs. S., V-paro, patient from whom x-ray in Fig. 394 was taken. Note the fundus; the bulbous neck; the lower segment; the contraction ring; the tense round ligaments. A full bladder may present a picture resembling this.

into the hand; (7) the presenting part has disappeared from the inlet or has become freely movable.

The author makes it a rule, after every operative delivery, whether or not symptoms are present, to examine the uterus, at least the lower uterine segment, with the whole hand and determine, beyond the suspicion of a doubt, the extent and location of any injury. This practice cannot be too strongly recommended.

**Differential Diagnosis.**—As a rule, during labor, little difficulty is experienced, but sometimes one has to consider abruptio placentae, placenta previa, and extra-uterine pregnancy. These have already been discussed under their respective headings. Collapse during or after labor may be due to something else, but rupture of the uterus is first to be thought of.

An important diagnosis to make after delivery is whether the rupture is complete or incomplete, since the principles of the treatment depend on this. Abdominally, little can be done in rare instances a hematoma may be outlined. Emphysema is not distinctive, nor are signs of peritoneal irritation. Vaginally, the presence of intestines or omentum is, of course, conclusive.

but not the discharge of peritoneal fluid, which may be simulated by the serum squeezed out from a blood-clot. The internal examination alone can be relied on to differentiate, and here it may be necessary to use the hand without a rubber glove. This is the only instance where I have had to use the bare hand. The fingers gently pass through the uterine portion of the tear, and come into a space filled with soft clot. Strands of fibrous tissue, nerves, and sometimes vessels span the space, and great care must be exercised to prevent breaking them. I once felt the uterine artery between my fingers pulsating ominously. If the tear is complete, the fingers pass directly into the peritoneal cavity, which may be recognized by—(1) The smooth, slippery surface of the adjacent uterus and of the abdominal wall; (2) the presence of gut and omentum; (3) the great freedom of motion for the fingers; (4) the fingers may lift up the abdominal wall from the inside; (5) outlining the edges of the wound. To recognize the thin, veil-like layer of peritoneum over an incomplete rupture—(1) Note if the fingers are confined to a ragged, walled cavity; (2) try to determine the upper uterine end of the rupture, and find if the peritoneum has been stripped off the uterus here; (3) bimanually, determine if there are any structures between the hands; (4) try to slide the questionable layer of tissue over the fingers, or depress it by the abdominal hand between the two parted internal fingers; (5) note the relation of the gut to it. In the last instance the peritoneum may be so thin and stripped off the underlying structures so extensively that the gut appears to be within the grasp of the fingers, uncovered. Here the differential diagnosis is not so necessary, because in such cases the thin veil of peritoneum will in all likelihood slough off, so that the treatment is the same as for complete tears.

It is sometimes necessary to decide if other organs beside the uterus—the bladder, the rectum and bowels, the omentum—are involved. If there is the least suspicion of such an injury, the case is to be treated as if it really were so. The bladder may be examined with a cystoscope. I discovered one injury in this way. The rectum may be explored, but if any injury higher up is suspected, the belly should be opened.

**Prognosis.**—This is grave in all cases, but, fortunately, the improvement of modern obstetric practice, with asepsis and early recognition and operative treatment of the accident, has effected a substantial reduction of the previous high mortality. Incomplete ruptures are a little less dangerous than complete ones, but the prognosis depends on so many conditions—the site, the extent and method of infliction of the injury, the presence of infection, the environment of the patient (hospital or home), the kind of treatment, etc.—that figures are practically useless. Of the author's 11 cases of complete rupture, 8 died of shock or sepsis; of 16 cases of incomplete tear, 3 died—2 from hemorrhage and 1 from peritonitis. Cholmogorof, in 1894, found mortalities given by different clinics from 21 to 65 per cent., depending on no particular line of treatment, and Koblanck showed 73 per cent. and 78 per cent., Braun, 63 per cent., that for incomplete tears being 25 per cent. For the child, the outlook is still worse. Unless the delivery can be completed at once, the child is surely lost. When the rupture occurs at the end of the second stage, the child may come out alive. If it is forced out into the belly, it usually dies in a few minutes, but three cases are on record where a hasty abdominal section rescued it.

If the mother survives the hemorrhage and shock, her life depends on the presence or absence of infection. Peritonitis is the rule because the cases are usually in the hands of midwives or unclean attendants. Even if she recovers from this labor she is threatened by a worse recurrence of the accident in her next one. Perfect health is never restored; the uterus remains large (chronic metritis), the laceration scars distort and displace it, and the pelvis is permanently the seat of venous congestion.

**Treatment.**—Prevention of rupture of the uterus is one of the regular duties of the accoucheur, and forms part of the "watchful expectancy" so often spoken of in the treatment of labor cases. If a diagnosis of *ruptura uteri imminens* is made, the indication is to empty the uterus as quickly as possible, and, further, this must be done with the least possible increase of the intra-uterine tension, *i. e.*, with no further stretching of the already overstretched lower uterine segment, cervix, and vagina. If the cervix is imprisoned in the pelvis, it must first be pushed up, because traction on it from below would stretch it still further in the length and cause the transverse tear which was impending. If all the conditions for forceps are fulfilled, this is the operation of choice, but it may not be forced, since the dragging down of the child may pull the thinned cervix apart. Cranioclasia, followed by cleidotomy and evisceration, is preferable and more humane. It is criminal to attempt version in these

**e case per vaginam**, these things must be considered: (1) The statistics; (2) **e environment** of the patient; (3) her condition as regards infection and bleeding; (4) the skill of the operator. Statistics, as usual, are unreliable guides, **lien finding** that 44 per cent. recovered with laparotomy, while only 39 per cent. **ith drainage**, and Kolaczek finding that only 25 per cent. recovered after laparotomy, while 39 per cent. recovered with drainage. In poor surroundings drainage **e is better** than celiotomy, and since it is dangerous to transport these patients, **e argument** for drainage is stronger. In cases of infection it is hard to decide, but the majority of authorities seem to be on the side of extirpation of the **erous**, with most thorough drainage below. Vaginal extirpation should show **e best results** here. In the milder cases hemorrhage may be controlled by light **mponing** of the rent, but if severe, the belly must be opened. When injury to **lacent viscera** is suspected, immediate laparotomy is demanded. In the hands of **e general practitioner** drainage is the operation of choice, while in the equipped **aternity** more radical measures may be attempted. Scipiades, of Budapest, in **10**, basing his judgment on an experience of 97 cases, says drainage is best even in **spitals**. My own experience in hospital, dispensary, and consultation practice **is convinced** me that drainage of the peritoneum and the tear is the best general **eatment**, and that laparotomy is to be done to meet special indications. In **ean cases** part of the rupture should be united by suture. This is accomplished **r exposing** the wound with very broad specula, and pulling down its edges with the **rvix** forceps (Figs. 689 and 690). In one case, in 1898, in order to bring the deepest **ortions** of the rent within reach, I detached the bladder from the cervix in a manner **milar** to that of the vaginal cesarean section. After the tear is nearly all sewed **ie space** above is drained with a few strips of gauze or a soft-rubber tube, as **ick** as the finger. Anemia and shock are to be treated as usual.

I have not yet had an opportunity to use the Momburg belt in a case of rupture **f the uterus**, but can understand that it might be valuable to arrest hemorrhage **hile** the rent is being examined and repaired.

**Incomplete ruptures** are best treated by light packing. If the rent is packed too **ghtly**, the thin peritoneum may be burst through, or may split over the tampon **uring** the transport from table to bed, or during the restless tossing of the parturient. If the peritoneum is lifted off its attachments for a great extent, especially **i multiple ruptures**; if there is a suspicion of infection; if the hemorrhage is **obinate**; if the wound is complicated—the case is to be treated like a complete **rupture**. It may be possible to reach the field of an incomplete rupture by an **cision** similar to that made for ligating the internal iliac artery.

**After-treatment.**—Ergot and hydrastis will help to keep the uterus contracted. **A firm abdominal binder** should be applied, though if it is needed for counterpressure **o aid a tampon** in stopping hemorrhage not much may be expected. I got good **results** in one case by sitting by the woman's side and holding the uterus down **against the tampon** for two hours. The gauze is removed on the third or fourth day, and a smaller strip inserted or a tube substituted. It is wise not to let the wound close too rapidly. If signs of infection appear, a vaginal examination is required to determine the presence of an exudate.

Since the site of a healed rupture of the uterus is not strong, the muscular fibers near it being usually atrophied and the scar friable, it is best to instruct the patient **that in a subsequent pregnancy** she should spend the last four weeks in a maternity. As soon as labor declares itself cesarean section should be performed. If this advice is unheeded, the accoucheur should, when called during labor, terminate the case with forceps as soon as the conditions are present. Induced labor is slightly less dangerous than labor at term, but if pelvic obstruction is to be overcome, it is not, and the abdominal delivery at term is imperative. The induction of abortion for this indication alone is not allowable.

## RUPTURE OF THE UTERUS DURING PREGNANCY

This is one of the rarest accidents of pregnancy, if one excludes perforation of the uterus by criminal abortionists. Baisch, in 1903, collected 78 cases. A healthy uterus will tear on the most violent indirect injury; but if the muscle is diseased, it may give way during the growth of pregnancy, or during one of the contractions of the uterus, or from the shock of a cough, etc. Ruptures of the uterus during pregnancy are to be divided, as in labor, into spontaneous and traumatic. The latter group must be further divided into those due to direct application to the uterus, and those occurring indirectly, as from a fall or straining of any kind. Spontaneous rupture may occur from yielding of the scar of a previous cesarean section, previous rupture, injury, or from gynecologic operations (fibroid, curetage, etc.); thinning of the uterine wall from manual removal of the placenta, especially if repeated; hypoplastic uteri, as single or double horned; interstitial pregnancy; actual disease of the uterus, as sarcoma, hydatid mole, fatty and hyaline degeneration, previous infection, and small-cell carcinoma; growth of placental villi into the uterine wall; abruptio placentae (the uterus may rupture over the retroplacental hematoma); displaced and adherent uterus; in short, the same conditions which predispose to rupture during labor.

Examples of direct traumatism are: Puncture of the uterus by sounds, curets, or other instruments, used in operations or to produce abortion, by bullet, the horn of a steer, etc. Traumatism is often the cause, but often a disease of the uterus preexists, because the normal



FIG. 698.—TRAUMATIC RUPTURE OF FUNDUS UTERI IN NINTH MONTH OF PREGNANCY.

can withstand much insult without injury, as witness the case of Hofmeier, where the woman fell from a fourth-story window without rupture, and the one where a drunken man jumped upon a prostrate woman's abdomen without even causing abortion.

**Clinical Course.**—Baisch found 31 cases of rupture during the first five months of gestation, and in these the uterine wall was diseased. In the later ruptures scar tissue was usually present. The symptoms resemble those of ruptured extra-uterine pregnancy, but the shock is usually less marked, especially when external violence is the causative agent. Pain in the abdomen is usually present, and labor-pains may occur—this when rupture is incomplete. These contractions may continue and expel the child from the uterus, after which they subside. When the peritonitis pain recommences, but usually the patient complains of a tender body in the abdomen from the start. Vomiting, hiccup, and other signs of peritoneal irritation are usually present, together with signs of internal hemorrhage.

In Davis', Leopold's, and Henrotin's cases gestation continued, with the child and placenta in the uterus, the cord issuing from the hole in the uterus, but these are exceptional, the rule being that the child dies, becomes infected, and peritonitis closes the scene. It is possible that a lithotomy may result. The hemorrhage may be internal, external, or both; sometimes the child is born dead, and there is no hemorrhage at all, so that a diagnosis cannot be made until the belly is opened. Hematomata are rare, because the tears are usually fundal. Rupture may sometimes occur in the anterior or posterior wall, and also, but rarely, in the lower part of the uterus. When labor-pains are forcing the child out through the tear, a bag of waters may form over the child, and it may be even delivered through the vagina before the fundal tear is completed.

Instrumental perforations, if done aseptically and not large, bring on abortion and may heal unnoticed; if done, as usual, without asepsis, they cause decomposition of the uterine contents and peritonitis. (See Septic Abortion.)

**Diagnosis**—This is almost always very difficult, but since most of the conditions which simulate the accident require laparotomy anyway, it is not absolutely essential. To be considered here are torsion of a tumor near the uterus, rupture of the liver, gall-bladder, or spleen, ileus, ruptured ectopic gestation, abruptio placenta, and placenta prævia.

The treatment is laparotomy as soon as the diagnosis is made or becomes even only probable.

### INVERSION OF THE UTERUS

Fig. 699 shows a complete inversion or turning inside out of the uterus, together with prolapse, i. e., prolapsus uteri inversi. Lesser degrees occur, and only the placental site may be depressed, as in Fig. 708, p. 793—the so-called atony of the placental site. All grades between

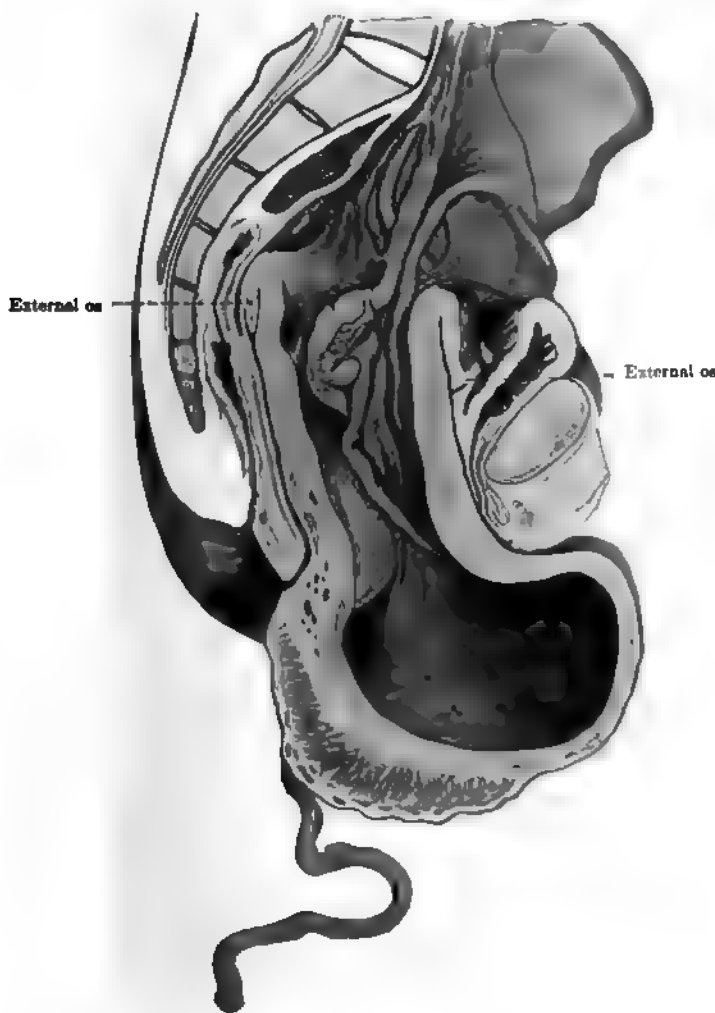


FIG. 699.—INVERSIO UTERI TOTALIS (adapted from Tandler).

these two extremes are observed, and are called incomplete or partial inversions, the most common of which are those in which the fundus comes to lie in the vagina just within the introitus, and feels like a soft, large, globular, fibroid polyp. The placenta may still be attached, or only partially adherent. If the inversion occurs after the third stage, the naked uterus lies in the vagina or may be expelled outside, in which case the open sinuses and tubal ostia are visible. In the "inversion funnel" from the abdominal side the tubes, ovaries, the round and broad ligaments, sometimes the gut and omentum, may be seen.

**Etiology.**—In one of the author's cases, during the removal of the placenta, the uterus was felt to contract, the contraction ring opened outward, a condition shown in Fig. 700 appearing for

bleeding are often complained of, with dragging pains in the back and a feeling of bearing down, but, remarkably, one or all of these symptoms may be wanting.

**Diagnosis.**—If only the attendant would bear this accident in mind, there need be no difficulty in making the diagnosis on the direct examination. A large, roundish tumor in the vagina, with absence of the fundus uteri from its proper place, in the presence of shock and hemorrhage, will clear up the situation at once. It may be possible to feel the inversion funnel from the abdomen after the bladder is emptied. In the differential diagnosis fibroid polyp, adherent placenta, and total atony of the uterus are to be considered, and a careful bimanual examination will easily decide between them. The inverted fundus has been torn off under the notion that it was the placenta alone; it has been cut off as a tumor, and the whole uterus has been pulled out as a second twin! If the fundus is prolapsed, the bright-red, rough, bleeding endometrium, or the placenta, cannot fail to tell what has happened. In debating the causes of postpartum shock inversio uteri must be considered with rupture of the uterus, hemorrhage, etc.

**Prognosis.**—This is better now than formerly, by grace of asepsis and better obstetric practice in general. Croase, in 1843, found that 80 of 109 reported cases died; Vogel, in 1900, reported only 22 per cent. mortality; Zangemeister, in 1913, 23 per cent. Even some of the cases where the



FIG. 702.—DIAGRAM SHOWING METHOD OF REPLACING INVERTED UTERUS.

After the whole hand, grasping the uterine body, has replaced same in vagina, the constricting cervical ring is spread by means of the fingers and thumb, while the palm of the hand forces up the fundus in the directions indicated by arrows. The outside hand aids to dilate the funnel.

uterus has been torn off recover if infection is absent. Reposition improves the outlook. It may be possible even after twenty years.

**Treatment.**—Although inversion of the uterus is rare, the accoucheur's routine technic in handling labor cases should comprise means for its prevention. Traction on the cord must be avoided, and, while drawing the membranes off the uterine wall, the outside hand must lie on the fundus and assure its contraction. Atony of the uterus postpartum is to be rectified as soon as possible. In turning the newly delivered woman from side to side, or when she raises her hips for the removal of soiled bed-clothes, the bed-pan, the rubber pad, etc., the attendant must lay a hand on the uterus and be sure that it is firmly contracted. During the manual removal of the placenta the first indications of inversion are to be corrected.

What to do in acute cases requires deliberation, because if the attempt is made to put the uterus back while the woman is in deep shock, the delicate balance will be turned against her. Zangemeister showed that 23 per cent. died when operated during shock, while none died when reaction was awaited. Here it is better to replace the fundus in the vagina, pack the latter firmly with antiseptic gauze, and let the parturient rally. If bleeding is going on, however, it may be necessary to risk the added shock in order to stop it. Ether is the anesthetic of choice, but sometimes only a little encouragement is required to enable the woman to stand the operation. The shoulders should be raised a little to avoid air embolism. It is best to remove the placenta cleanly before reposition is attempted, but if the case seems favorable the removal of the placenta

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## CHAPTER LX

### INJURIES TO THE BLADDER, RECTUM, ETC.

#### THE BLADDER

DURING labor the bladder is drawn up with the unfolding lower uterine segment, and, when overfilled, forms a rounded tumor above the pubis, extending sometimes even above the navel. It may be mistaken for the dilated lower uterine segment and contraction ring. The full bladder may prevent delivery by weakening uterine action, by making it too painful or impossible for the woman to bear down, and, if it is filled before the head has entered the pelvis, by preventing engagement. Catheterization will make the diagnosis and cure. Tumors of the bladder have caused dystocia, as also have vesical calculi. The head may crush them against the bone and break them, or the vaginovesical wall may be rubbed through, causing fistula. Such obstructions should be pushed up out of the pelvis with the patient in the knee-chest position, and if this is not possible, removed per vaginam. Varices of the bladder may rupture during pregnancy and labor. A kidney may be displaced and become adherent over the inlet, causing dystocia. Horseshoe kidney has thus been observed, but it need not give trouble. Cystocele may come down before the advancing head and delay delivery. It has been punctured for the bag of waters, and torn off as a tumor. The cystocele is not so much to be feared as the abruption of the base of the bladder from its pubic attachments. The duplication of the connective-tissue strands which radiate from the neck and anterior wall of the bladder to the pubis and ligamentum arcuatum—the so-called pubovesical ligaments—are stretched, separated, and torn, allowing a descensus of the bladder. In addition the fibers between the bladder and vagina and those in the base of the broad ligaments which support the bladder are also disrupted, all of which causes cystocele and prolapsus vesicæ. Unfortunately, little can be done during labor to prevent this downward dislocation of the lower half of the bladder. The protruding organ may be gently pushed back above the advancing head, and in a few cases I have done episiotomy to deflect the head from the posterior surface of the pubis and thus relieve the crowding here. For this purpose the operation has not been often enough performed.

#### FISTULAS

*Fistulas* are false passages between adjacent hollow organs, and in the pelvis are almost always due to labor, but cancer, etc., may ulcerate, leaving such defects, while foreign bodies, such as pessaries or objects introduced for purposes of masturbation, sometimes do the same. Fistulas due to labor are getting rarer every year by grace of the better practice of obstetrics. In my student days such operations were not uncommon—now they are curiosities.

Pressure necrosis of the bladder results from prolonged compression between the head and the pelvis. This was discussed under Contracted Pelvis. Usually the vaginovesical septum is caught between the two hard objects, and as the result of the prolonged arterial anemia, the area under the compression necroses and is cast off as a slough in the first week of the puerperium, causing incontinence of urine. If the cervix is not dilated, but caught in the zone of compression, the resulting fistula will be cervicovesical, perhaps uterovesical, or ureterocervicovesicovaginal. All sorts of combinations occur (Fig. 703). Without doubt bacteria



d in causing the necrosis. In their absence the tissues tolerate much more pressure. Fistulas are caused also by direct traumatism, an instrument being punched through the bladder or cutting the ureter, or from a wound of the uterus extending to the bladder or involving the ureter. Forceps, the sharp hook, or the cranio-ist have thus torn great gashes, and sharp spiculæ of bone in the operation of amiotomy have cut deeply into the soft parts. Posteriorly, the cervix may be caught between the head and the promontory, or the rectum may be compromised. In the former case adhesion of the uterus to the promontory may result, or, if the tissue necroses, perforation and peritonitis, in the latter case, rectovaginal fistula, which is rare.

The prevention of fistulas has already been considered. Knowing the causes, and by observing that the portions of the parturient canal below the point of

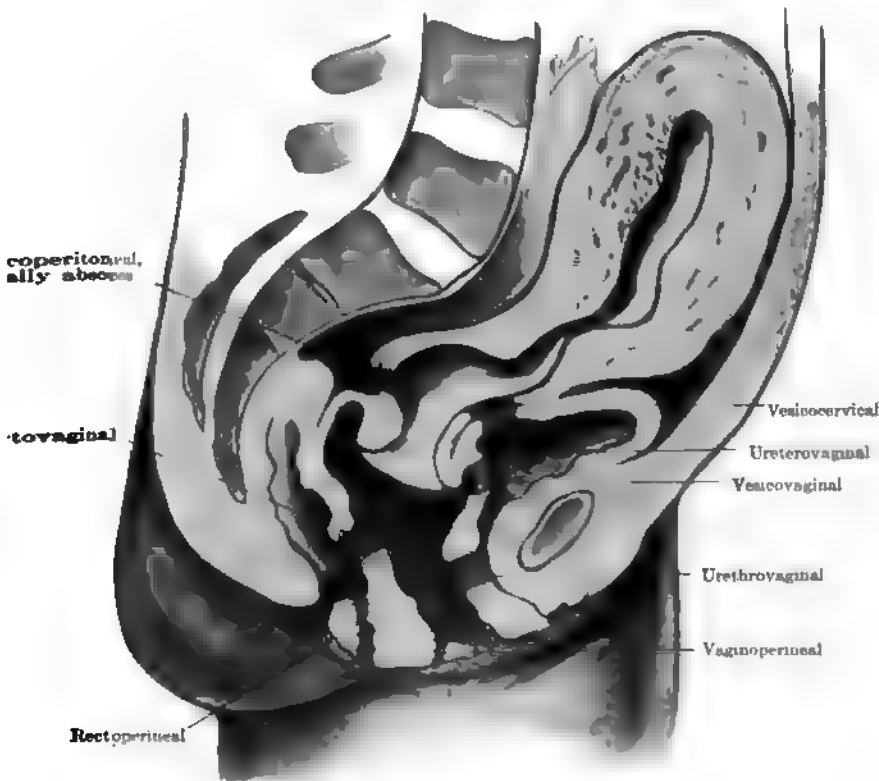


FIG. 703.—SITES OF FISTULAS.

impression are becoming swollen, the suspicion of danger is grounded. Palpation of the thin portion and bloody urine confirm it.

Immediate delivery as soon as danger is recognized is the treatment, but the delivery itself must be a protective one. After delivery the bladder is catheterized, and the fact that there is no perforation established; then, if the possibility of too long compression and the fear of a fistula by necrosis are entertained, the woman must be instructed to urinate regularly every four hours, or the bladder must be emptied so often, with a view to avoid further danger of sloughing. Hexamethylenetetramin, in 5-grain doses, is administered four times a day as a prophylactic.

Infection often accompanies such injury, which is unfortunate, because the scars which result from the ulceration radiate to the sides of the pelvis, even to the one, and, by contracting, pull open the fistula and prevent its closing, also render-

ing difficult the operations for cure. If sloughing of the compressed area ensues the administration of urinary antiseptics should be kept up, but bladder irrigations are unnecessary, since there is free drainage. The development of eczema from the continuous dribbling of urine is prevented by proper nursing. A thick salve containing carbonate of zinc, zinc oxid, and vaselin is useful. Later a urinal may be worn. Small fistulas, especially of the traumatic variety,—that is, those perforations not attended with extensive necrosis and radiating scars,—often heal spontaneously. Operation is not to be performed until the parts are thoroughly healed and devascularized, that is, about four months postpartum. Suture at this time, I have found, gives the best results. Although properly belonging here, the operations for the repair of fistulas may not be discussed because of the lack of space.

If a woman whose fistula has been successfully repaired becomes pregnant again, abortion may not be induced, but the advisability of cesarean section at term should be debated with the family. The healing of fistulas is so precarious that this operation should be performed, certainly if the original fistula was a complicated one. Only too often the trauma of the labor reopens the old wound and a new operation may not be at once successful.

### INJURIES TO THE RECTUM

Rectovaginal fistulas the result of compression necrosis and direct injury by instruments or spicules of bone have been referred to, as also have been those cases where the rectovaginal septum gives way over the advancing presenting part, head, arm, or breech, and the latter appears at the anus. Splitting of the mucous membrane of the rectum or of the anus is not rare, and results in fissures which may cause painful defecation, bleeding, even local infections. Injury to the rectum may be produced by Ritgen's and Olshausen's maneuvers for delivery of the head. Without doubt much of the pain of delivery is due to stretching and dislocation of the rectum and of the fourth sacral nerve, which supplies the levator ani. The rectum may be implicated in rupture of the uterus.

### THE PELVIC JOINTS AND BONES

Softening and relaxation of the pelvic joints have already been discussed, and the value of this factor in the mechanism and treatment of labor pointed out.

**Rupture of the pelvic joints** during labor, while rare, is not so uncommon as is generally believed. I have treated 8 cases and have learned of 4 others. In 1898 I published 2 cases; in 1901, 2 more, and gave the literature to date (Kehrer).

**Rupture of the symphysis pubis** is most often found, but sometimes the sacroiliac joints are involved, either alone or with the former. It may be partial or complete. Traumatism causes rupture of the joint, but since it requires the enormous force of from 400 to 2600 pounds to disrupt the pelvic girdle, some inherent weakness of the joint must preëxist. Softening and relaxation of the capsule, caries, rachitis, osteomalacia, chronic rheumatism, trauma during pregnancy, congenital weakness of the ligaments, have all been found in such cases when even the distention of the pelvis during spontaneous labor may cause the joint to give way. Contracted pelvis, especially the justminor and funnel varieties, predispose, because the expansile force acts in the narrow transverse diameter. A large child or especially broad shoulders may act in the same way. In three-fourths of the cases the joint is sprung during operative delivery, and in my collection the forceps caused 67 per cent., and the others, the after-coming head, the shoulder, and the vectis (Boddsett). In one case the rupture occurred postpartum while the woman got out of bed, but probably the separation had been started by the delivery and was thus completed. Improperly directed forceps traction, as by pulling upward too soon or by pulling upward with the patient on a low bed, in both cases the head acting as a wedge

between the rami, or using too great force, will produce the rupture, perhaps even the absence of pathologic softening. These facts are important from a medical point of view, but as a rule the physician may not be held responsible, less it can be shown he employed undue force in delivery.

*Symptoms.*—The patient may have complained of pains in the pubis and sacro-coccygeal joints, with difficulty of locomotion for several weeks. During spontaneous rupture the rupture may be discovered at the moment it occurs, being heard as a dull clicking, or the woman says something has burst. Usually the operator feels and opens the joint open during the operative delivery, and notes that the obstruction to the progress of the child has suddenly disappeared. Later the patient complains of intense pain over the affected joint and radiating down the thighs, and cannot move the legs, which lie everted and abducted. It is a sort of pseudoparalysis, and doubtless has often been mistaken for acute paraplegia due to injury of the nerves in the pelvis or an acute infectious myelitis. Overstretching of the joints without actual rupture sometimes occurs in difficult forceps cases, and makes the woman crippled for months. Bladder and rectal symptoms are absent unless the viscera are injured at the same time, which is not rare.

When spontaneous cure results, fibrous union takes place between the ends of the bones, but excessive play at the joint may render the patient invalid for years. In general the results correspond with those after symphysiotomy. If the vagina communicates with the wound, suppuration is the rule. Sometimes infection of the joint occurs through the blood or by contiguity, especially if infection of the nutrient canal exists. In pubic arthritis complicating general sepsis it is hard to decide if the joint was primarily or secondarily involved. Chills and high fever mark the advent of infection to the joint; pus forms rapidly, burrows far, and makes a big abscess unless evacuated early, and may even cause fatal pyemia. Gangrene of the feet, pulmonary embolism, cartilage sequestration have occurred.

The *diagnosis* is usually easy if the condition is at all considered. The history of difficult delivery, the position of the patient in bed, the pain and tenderness of the pubis, the palpation of a groove over the joint, with movability of the pubes on each other, enable one to make the diagnosis on the direct examination. In the differential diagnosis paraplegia must first be excluded, which is done by finding the reflexes normal, the individual muscle groups functioning, and normal sensation.

Later, after fever has developed, in their order must be considered acute sepsis, pelvic inflammations and pressure on the nerves by the pelvic exudates, acute toxic arthritis, myelitis, cystitis, or even only full bladder and hysteria. When an abscess is formed around the joint, one must determine if the suppuration is primary or secondary—that is, part of a general infection, the latter mainly for the prognosis. When recognized early, this accident is very dangerous, although often recovery and partial restoration of function occurs, the latter requiring from three to eight weeks, after symphysiotomy. Injuries to adjacent viscera, primary hemorrhage, shock, and acute sepsis, bring the mortality of reported cases up to 35 per cent. Infection of the joint is serious, and very serious if more than one is involved, because the abscess burrow far and wide. Permanent wide separation of the ends of the pubis may require a bone operation, wiring or nailing, to restore function. The treatment is the same as after symphysiotomy (q. v.).

Loosening of the sacrum from the innominales may result from labor, and, without doubt, explains many of the cases of backache after normal as well as operative delivery. Pain and tenderness over the joints, abnormal mobility, the latter determinable best by intrapelvic exploration, the pelvic organs being free of disease, will make the diagnosis. The treatment is along orthopedic lines.

*Injury to the Coccyx.*—During delivery the coccyx is forced backward an inch or more, an excursion of the bone being permitted by a healthy sacrococcygeal joint. If the joint is ankylosed, the bone itself may be fractured, or the joint may break open, a chronic arthritis resulting.

Dislocations of the bone on to the anterior or posterior surface of the sacrum occur, as pericoccygeal cellulitis, which is chronic and very painful. Without doubt many, if not the cases of so-called coccygodynia are referable to the above conditions. After injury the bone ends may unite at a right angle, or such deformity may occur at the joint, though because the bone is moved so frequently (walking, defecation, sitting), a pseudarthrosis is

Even while the woman is in bed there are symptoms referable to the injury, as pain on motion, and tenderness, but usually the first sitting-up attracts the attention of the accoucheur. Inability to sit with comfort, the patient often resting her body on either trochanter, pain on sitting up the back and down the thighs, difficulty of locomotion because of pain, painful defecation, intense nervousness—often a real neurasthenia—are the main symptoms. The diagnosis is suggested since the history will draw attention to the location of the trouble, and an examination with the index finger in the rectum and the thumb over the coccyx will show dislocation of the bone, (crepitus), or excessive tenderness in or around the joints (Fig. 704). The x-ray also is helpful.

Spontaneous recovery is the rule, but sometimes it requires many months.

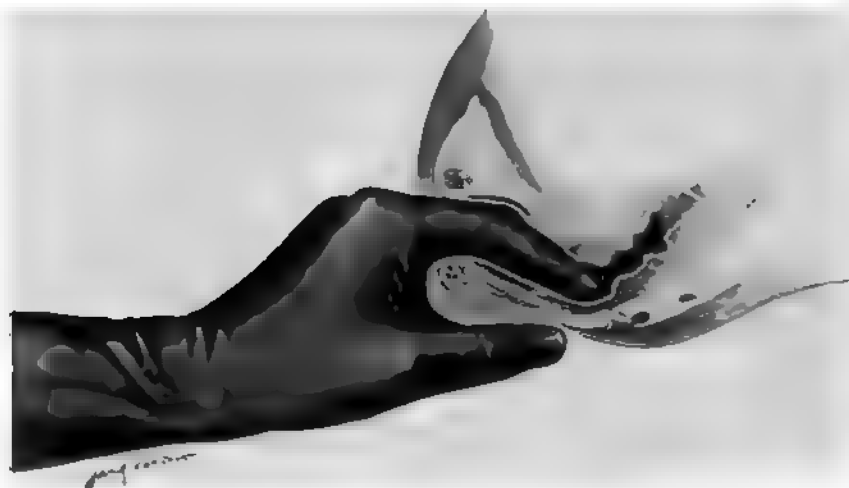


FIG. 704.—PALPATING THE COCCYX WITH A FINGER IN THE RECTUM.

**Treatment.**—Local applications give very little relief. In cases of cellulitis a gentle massage after the acuteness has subsided, will help. For fracture and dislocations a period of at least six months should be allowed for spontaneous cure, and then, in the absence of improvement, the bone is to be excised. For three days before the operation the bowels are to be kept free, the patient put up with bismuth and a few doses of opium, as before operations for fistulas. Sim's position is used. A 2-inch incision is made over the joint, and the firm fibrous tissue is cut down to the bone, which is bared and lifted up with a bullet forceps. With a sharp knife it is detached from the coccygeus on each side and the lower fibers of the sacrosacral ligament, taking care to avoid the fascia on its anterior surface. The joint is severed last, or, if the fracture had no displacement, the distal portion of the bone is excised and the proximal portion smoothed with the bone file. The whole coccyx had best be removed. The rectum is attached to the end of the sacrum by a few firm strands of connective tissue; care is required to prevent tearing this organ. Hemorrhage is stopped by packing with hot iodoform gauze for a few minutes. Then the two edges of the coccygeus muscle are united in the median line by interrupted catgut sutures; next the skin is closed with a whipstitch, which was over the bone, then three or four deep silk-worm-gut sutures close the skin. Compression of the edges of the skin should be obtained, and the wound painted with iodine. The patient should keep the side position for three days. Two ounces of liq. petrolatum should be given daily, and on the tenth day castor oil. It is highly important that feces and urine do not enter the wound, and the patient should sit up straight or bend forward when the bowels move.

**Other Injuries.**—As the result of overpowerful bearing-down efforts the woman may rupture her sternum or dislocate one or more ribs upon it. The severe straining may rupture the pleura of the lung and give rise to emphysema of the neck, chest, even of the entire body. Keiser, 1907, collected 77 cases in the literature since 1791. I have seen two. Primiparae are most affected. Tenderness and dyspnea are prominent; the prognosis is good, the swelling disappears in a few days without treatment.

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## CHAPTER LXI

### POSTPARTUM HEMORRHAGE

STRICTLY speaking, postpartum hemorrhage means bleeding after labor, that is, after the placenta is delivered, but for purpose of study it is best to consider under this heading all hemorrhages occurring from the time the child is delivered until the puerperium is completed. Those which occur after the first twenty-four hours are called late hemorrhages, and will be considered separately. At present we are concerned only with those attending the delivery of the placenta and immediately thereafter.

The reproductive function is the only one normally attended by hemorrhage, and nature, by wise provision, fortifies the woman against the inevitable loss, and even overprovides, so that she may survive a drain that would prove fatal in a non-pregnant female or a male. During pregnancy the total quantity of blood is increased, and the fibrin is also greater in amount, these changes beginning after the fifth month. There is a slight leukocytosis which becomes marked (16,000) during labor. In healthy gravidæ these are the changes, while in a sickly or anemic woman, pregnancy may induce a condition of chloranemia. The point has a strong clinical bearing.

In healthy gravidæ a loss of blood up to one pint (500 gm.) is usually borne without any symptoms, and it is generally believed that the woman has gained about this amount during pregnancy. The average loss during labor is about 300 gm.—8 to 10 ounces. It is best to consider a loss above a pint as pathologic. Bloodless labors are very rare, and are usually found where the fetus has been dead a long time and firm thrombosis has occurred in the placental site. Leukemics also are said to have bloodless labors, which is fortunate, if generally true, because leukemics stand bleeding badly. Before the expulsion of the placenta the oozing should be very slight, if any, and after it the puerpera should not lose over 3 ounces of fresh blood in the first two hours. Inclosed in the placenta will be found the bulk of the blood. If the blood gushes from the genitals or oozes steadily in larger amounts than here indicated, the case is pathologic.

#### ETIOLOGY

During the separation and expulsion of the placenta hemorrhage is prevented by the retraction and contraction of the uterine muscle and by thrombosis of the uterine sinuses. The more important factor in securing hemostasis is the uterine contraction, since thrombosis may be absent and no hemorrhage occur; and, conversely, thrombosis alone, unaided by the contraction and retraction of the uterus, will not check a hemorrhage.

The sinuses in the uterine wall are simply blood-spaces, lying between the muscular lamellæ and muscle-bundles, and lined with a single layer of endothelium. As the uterus empties the muscular lamellæ become superimposed, the muscle-bundles crowd closer together, these several layers sliding over each other. As a result, the blood sinuses are bent and twisted on themselves, the muscle effectually choking off the current of blood that flowed through them. There is even some influence on the larger vessels at the sides of the uterus after they enter its wall. The retraction of the uterine muscle does the actual work in this operation. The regularly recurring uterine contractions aid and support the permanent retraction.

Postpartum hemorrhage, therefore, will be most often found to be due to an anomaly of this physiologic mechanism, and such anomalies are usually due to weakness or abnormal contraction and retraction of the uterus. In practice find two additional factors—lacerations of the parturient canal and disease of blood or blood-vessels.

(A) *Lacerations* of the genital tract play a much more important rôle in production of hemorrhage postpartum than is generally believed. Many hemorrhages called atonic are due to tears in the genitalia.

Lacerations of the clitoris and of the bulbi may give rise to even fatal hemorrhage, as may also a ruptured varix of the vulva or vagina, though both are rare. Perineal tears seldom bleed enough to require immediate suture, and vaginal tears

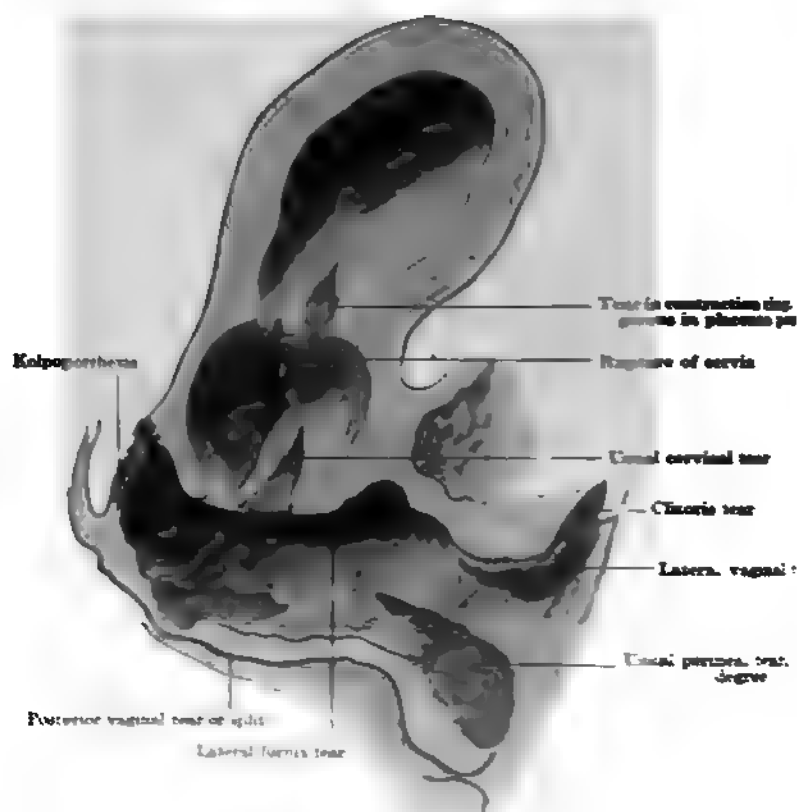


FIG. 705.—DIAGRAM OF TEARS OF PARTURIENT CANAL.

are also rarely attended by much hemorrhage. They may, however, require suturing or packing, and when they do, packing is the best method, because the field is inundated with blood that it is impossible to see where to place the suture. High vaginal tears, extending into the fornices, may lay open the bases of broad ligaments and may bleed furiously. They are usually combined with cervix tears.

A laceration of the cervix extending into the broad ligament may not be the result of tearing, but of gradual and not forced dilatation. Such findings are occasionally made after spontaneous labors or dilatation with one of the crushing dilators—the Borel, Seignoux, or the hands (Bonnair, Harris). Usually, however, a deep cervical laceration gives rise to serious hemorrhage. Deep cervical tears are most likely to occur when rapid delivery is made before the cervix is completely effaced or shortened, the

**drawn up into the body of the uterus.** Even after the cervix is completely dilated a laceration of the upper fibers may result if the extraction of the child is forced during a spasmodic contraction of the lower uterus and upper cervix. Sometimes the head passes through the cervix and the contraction ring closes down around the neck of the child. Forcing the delivery in such a case may cause the shoulders to tear the edge of the contraction ring. In the last three varieties of cervical laceration the tear is more likely to be a longitudinal split of the cervical wall, usually lateral, extending more or less deeply into the broad ligament, and indicating that if it went much further it would have to be called a rupture of the uterus, incomplete or complete, depending on whether or not the peritoneal cavity was opened. Without doubt many cases of so-called postpartum hemorrhage are in reality ruptures of the uterus, as likewise are many cases of "shock" after labor. A rupture of the uterus occurring during an operation or spontaneously gives rise to internal and external hemorrhage, and such cases are not to be considered in this chapter.

When the cervix is torn after complete effacement, but before complete dilatation, few large blood-vessels are opened unless the tear extends into the bases of the broad ligaments.

Special emphasis must be placed on the lacerations of the cervix and lower uterine segment occurring in placenta prævia. It is usually thought that the frequency of postpartum hemorrhage in placenta prævia cases is due to uterine atony, while as a matter of fact atony is rare, there being often too strong uterine action. The branches of the uterine artery supplying the lower uterine segment are given off above the contraction ring, and therefore, are somewhat compressed by the contracting uterus before entering the relaxed lower uterine segment. While one would expect a placental site, located out of the active contracting zone, to permit free oozing, this is, to a large extent, prevented by the peculiar situation of the blood-supply. Hemorrhage, therefore, is due to some other cause, and this will usually be found to be a laceration. The extreme vascularization of the lower uterine segment and cervix, due to the placental implantation, permits every tear to bleed profusely. Since the veins and sinuses are situated close to the surface, a laceration one-eighth inch deep may cause uncontrollable hemorrhage and may be discovered only at the autopsy.

(B) *Insufficient retraction and contraction* of the uterus, or anomalies of the same, cause few of the fatal postpartum hemorrhages. They may be associated with any of the lacerations previously described, and when the tear is situated in the lower uterine segment, the absence of a firm restraining action of the uterus is apparent.

It is not feasible to try to separate anomalies of retraction from those of contraction. Normally, the two functions coöperate, and in practice we find that where the uterus does not contract well, it does not retract well. We will call a uterus atonic when the contraction and retraction of its muscles are insufficient or irregular, though etiologically and strictly other terms should be used. "Uterine atony" is a favorite term for these conditions, but it does not always apply to the case.

The causes of atonic hemorrhages are general and local. Generally weak women—those of excessive cultivation, who often have poorly developed genitalia and generally poor innervation—have slow labors and a greater tendency to atony in the third stage. Exhaustion from prolonged labor, especially if the parturient takes no food, may lead to atony. In some families a tendency to postpartum hemorrhage is transmitted. This is an entirely different condition from hemophilia, which is to be considered later. Some women have atony of the uterus in successive labors. This may be due to a persistence of a local cause. Blondes and red-haired women, in the author's experience, are likely to have hemorrhage postpartum, but how much is dependent on the constitution of the blood it is impossible to say. Myocarditis, valvular disease, and pulmonary affections are said to favor atonia uteri,

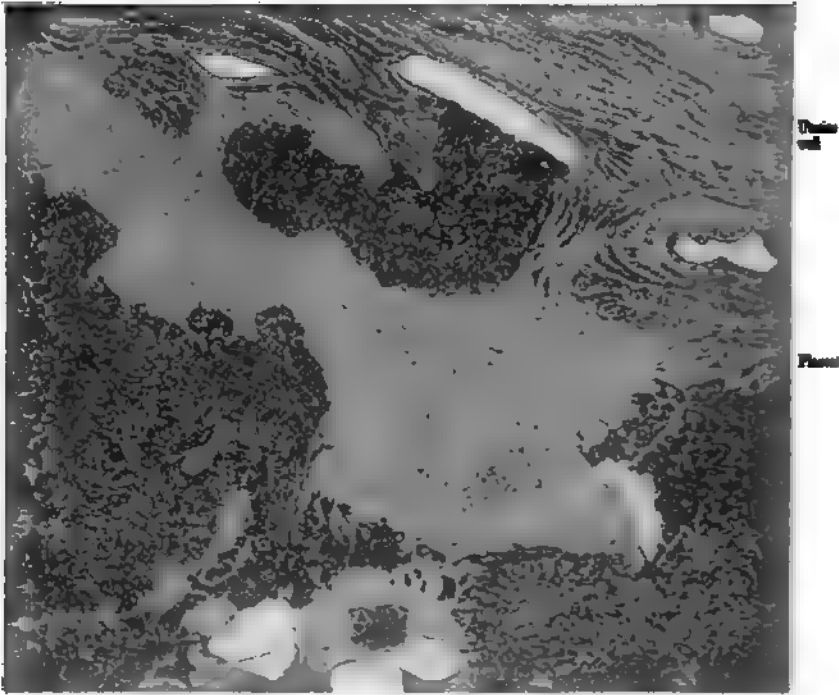


FIG. 706.—PLACENTA ACCRETA (from Schauta and Hirschmann).

but the writer has had little trouble with it in such cases. Chronic nephritis has been given as a cause of atony, a hyaline degeneration of the uterine muscles, disease of the blood-vessels being direct cause.



FIG. 707.—FETAL CAVITY PLACENTA, WITH IMPERFECT SEPARATION AND HEMORRHAGE.

The use of chloroform during labor doubtedly increases the tendency to hemorrhage, though this action is not constant.

Of local causes there are many: Overdistention of the uterus by twins—polyhydramnios; a large or diseased fetus, or an accumulation of blood (abruptio placentæ). The elongated muscle-fibers need time to accommodate themselves to the rapidly diminishing uterine cavity, so that sudden emptying of such a distended uterus nearly always predisposes to hemorrhage. Abnormal shape of the uterus—bicorned uteri, uterus arcuatus, septus, distortion of the uterus by adhesions (rare), distortion by tumors, as fibroids (common), old scars in the uterus, after cesarean section or ruptures—all these interfere with the traction and retraction of the organ and the sinuses to remain open, and from this more or less profuse hemorrhage occurs.

Metritis is given by J. Veit as a cause of atony.

Labhardt found an anatomic basis for hemorrhages in an increase of the uterine fibrous tissue around the sinuses. This may have preëxisted or have developed during pregnancy.



mitating frequent changing of the sheets. A wise accoucheur will make note of the number of changes. Sometimes the flow is interrupted, the uterus filling and emptying several times, or there may be one gush and that be all, the uterus having obtained a firm grasp of itself. The first blood is thick and deep red; later it grows paler, and it appears to me it has lost its clotting power. Sometimes the blood is dark, like port wine, and the clots are black, or it seems to be lake-colored—translucent; this an evidence of hemolysis.

The local findings vary with the cause of the hemorrhage. If from laceration, the uterus is usually hard, but sometimes it fills up with blood and becomes atonic. In real atonia uteri it is difficult to locate the flabby fundus; the whole abdomen feels boggy. If the placenta is incarcerated, the uterus is firm and globular, but balloons out between pains, and each contraction is attended by a gush of blood from the vagina (Fig. 709).

### DIAGNOSIS

Ideal obstetrics demands that no woman should lose enough blood to give rise to symptoms of anemia. If such are present, the accoucheur must quickly determine their cause, and shock, rupture of the uterus, inversion, rupture of an abdominal viscus, pulmonary embolism, and uremic collapse are to be considered. When the amount of blood known to have been lost is small and the uterus is well contracted, probably some other cause is acting, but the idiosyncrasy of the patient must be remembered. Almost always the question to decide is the source of the bleeding. Broadly speaking, a bleeding with a hard uterus comes from laceration, and when the organ is large, boggy, or even too soft to outline, atony is the cause. The history of the labor will give valuable data; if the uterine action was torpid in the first two stages, inertia may be expected in the third. (See Etiology.)

After forceps or other operations, lacerations are to be looked for, and they will be found in the operative field. Before the placenta is out it may be impossible to decide between atony and injury. As a rule, diagnosis and treatment go together, and this is the usual procedure: A brisk massage is given the uterus, and at the same time the vulva and introitus are sponged free of blood and inspected carefully for tears. If firm contraction of the uterus ensues, the hemorrhage ceasing, atony was probably the cause, and nothing further is done. If not, the placenta is removed. Now if the bleeding continues with a hard uterus, laceration is probably the cause. A vaginal examination will settle the doubt. Venosity of the blood is no criterion of atony. Concealed hemorrhage may be due to a tear as well as atony, and the blood may not appear for from five to fifteen minutes after delivery. It is oftentimes necessary to decide whether or not a piece of placenta or a clot is still in the uterus. In the first place, a careful inspection of the placenta should invariably be made immediately after its delivery, while it and the accoucheur's hands are still aseptic, because it may be necessary to at once enter the uterus. If the placenta is too much torn to guarantee certainty that nothing has been retained, and bleeding continues, it is best to revise the uterus with the hand. A large



FIG. 709.—Hour-glass Contraction. Imprisoned Placenta.

been sounded in time to have everything in readiness for instant use if necessary. Thus valuable time is saved. Forewarned is forearmed. During labor the possibility of postpartum hemorrhage must be borne in mind, particularly when the action of the uterus is sluggish, and in cases of overdistention, twins, polyhydramnion, etc. By supporting the parturient with food, rest, and help at the proper time



FIG. 710.—AUTHOR'S PACKING FORCEPS.  
It is 11½ inches long and rounded end is ½ inch across.

much can be done. Too early operative interference causes lacerations and hemorrhage. In delivery the uterus must be slowly emptied, and especially must the rules of the conduct of the third stage be closely observed.

*Preparations.*—Every obstetric kit should contain the apparatus for coping with this complication: (1) Instruments for the repair of lacerations (Fig. 664); (2) for douching the uterus, douche-can or bag, with tube and nozzle; (3) for packing



FIG. 711.—AUTHOR'S PORTABLE DOUCHE-CAN.  
This is of brass, nickel plated, with all corners rounded. Brass union for tube.

the uterus, uterine packing forceps (Fig. 710) and specially prepared gauze; (4) for the treatment of anemia, salt solution apparatus, or a sterile douche-bag or can (Fig. 711), a salt solution needle (Fig. 712), hypodermic syringe with stimulants, aseptic ergot, camphorated oil, ether, adrenalin, hypophysin, etc. Forearmed is forewarned. (For instructions regarding the preparation of gauze see Appendix.)

**Treatment of Hemorrhage During the Third Stage.**—When a severe bleeding follows the delivery of the child, the first move is to grasp the uterus and massage

Its mortality is placed by Bumm at 10 per cent. It is, therefore, best to make another attempt to remove the placenta by Credé expression after the woman is deeply narcotized.



FIG. 713.—SECTION THROUGH UTERUS AND PLACENTA (STILL ATTACHED), SHOWING LARGE VENOUS SINUSES AT PLACENTAL SITE AND HOW EASILY FINGER MAY PERFORATE WALL (Barbour).

A careful disinfection of the external genitals and the lower vagina should now be made. No hemorrhage is so dangerous that such preparations may be neglected. The danger of sepsis would

thus replace that of hemorrhage. The parts have already been clipped or shaved, and they have been well washed with antiseptic solutions during the delivery. Before inserting the hand the externals should again be liberally sponged with 1 : 1500 bichlorid and then with 1 per cent. lysol solution. The vagina should be well flushed out with 1 per cent. lysol solution, squeezing the solution from large cotton or gauze sponges. The use of rubber gloves cannot be too warmly recommended for obstetric practice, and, especially for this dangerous operation of invading the uterine cavity, they are almost indispensable. The gloves should be long, should fit well, and they should be drawn on dry, over sterile hands. A sterile towel is laid on the abdomen, and the hand put into the vagina avoiding the anus and perineum. The left hand is usually found to be most adapted for internal work. The fingers spread out in the cervix so that the membranes and cord fall into their grasp, then the tips of the fingers are brought together to form a cone for passage of the contraction ring (Fig. 713). It is seldom necessary to use force in passing this point. If ergot has been administered or if the contraction ring has closed down, it may be necessary to press the fingers firmly through the constriction. Profound anesthesia aids much, but in exsanguinated women it is better to operate without it if possible. The fingers seek the edge of the placenta, and the hand on the belly forces the uterus down over the inside fingers (Fig. 714). With a gentle combined movement the placenta is separated from its bed. It is usually very easy to separate the organ; but if it is pathologically adherent, tough strands will have to be sawn through by the fingers supported by the outside hand. A warning not to bore into or through the uterus must be given, because this is sometimes surprisingly easy (Fig. 715). Oswald reported 38 cases of it in 1903. The gut has been brought down; indeed, almost unbelievable as it seems, the spleen has been pulled out for the placenta (Kockel). After the placenta has been cleanly separated the two hands give the uterus a brisk massage, and a contraction will expel the hand containing the placenta. It is better to let the uterus expel the hand with the placenta than to drag the latter out. After washing the blood off the hand, and again sponging the parts with antiseptic solution, the hand is once more inserted, and the whole interior of the uterus carefully inspected. One must be absolutely certain that the uterus is perfectly empty. Care should be taken to remove all the membranes and thickened decidua. The rubber gloves are so slippery that shreds of decidua cannot be grasped. One misses the sharp finger-nail in such cases. The author uses a piece of gauze for the purpose of cleaning off the decidua and membranes, as in Fig. 716. One may now give a hot 0.5 per cent. lysol intra-uterine douche, which usually causes firm



FIG. 715.—HAND ARMED WITH GAUZE FOR WIPING PILE OF PLACENTA OFF THE PLACENTAL SITE OR REMOVING ATTACHED MEMBRANES.

contraction and retraction. A hypodermic of ergone, ergotole, or aseptic ergot is also administered, also one of hypophysin.

If it is impossible to remove the placenta, or if pieces of cotyledons or shreds of membrane are unavoidably left adherent on the uterine wall, a firm uterovaginal tamponade is made and the gauze removed in forty-eight hours. Missing portions often come away with the gauze.

**Treatment after the Placenta is Out.**—In all labor cases, as soon as the placenta has been delivered, inspect it carefully before throwing it in the drainage-jar. This is done at once, because if a piece of it is missing, one may adopt appropriate measures, and will not be surprised by a hemorrhage after the patient has been prepared

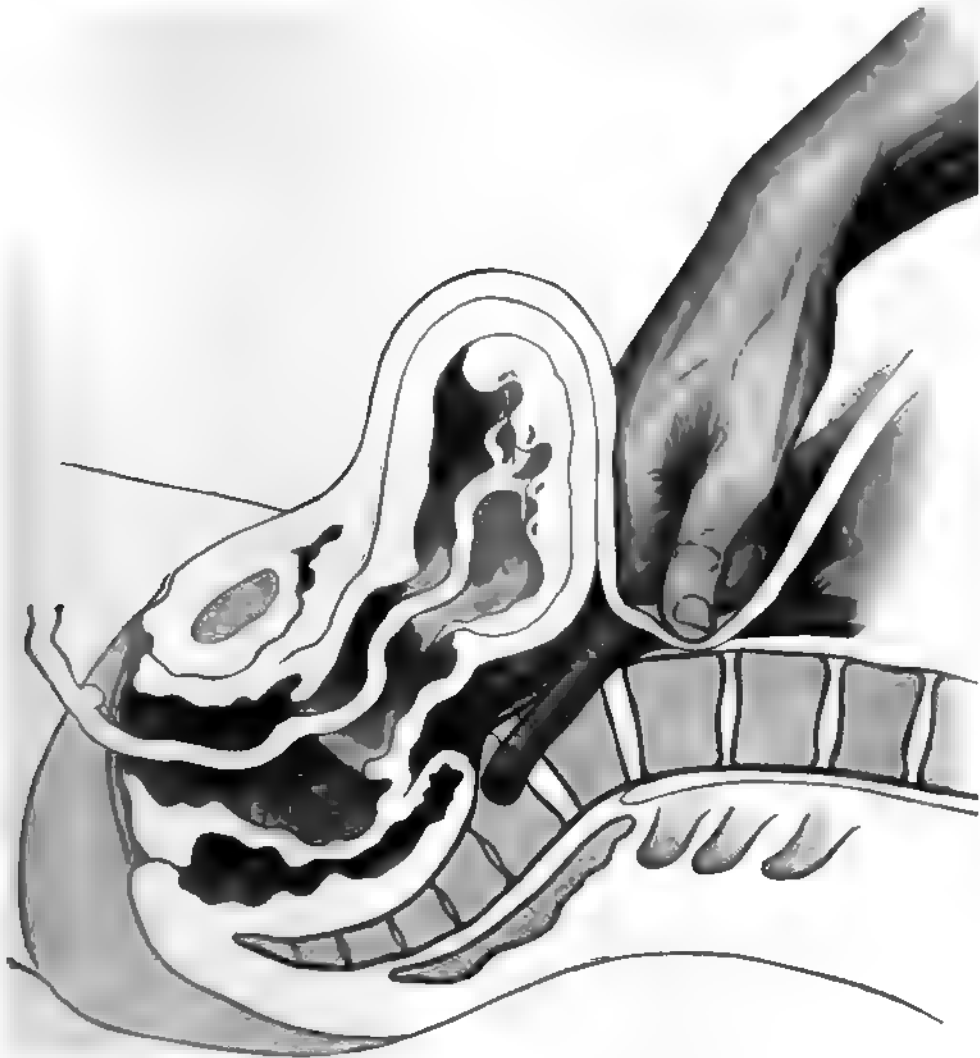


FIG. 717.—COMPRESSION OF AORTA.  
This method may be used in cesarean section also.

for bed, or, indeed, after the physician is ready to leave the house. If convinced that a piece of the placenta has been retained, it must be removed.

If the membranes are missing or incomplete, should you enter the uterus for their removal? Opinions of authorities differ. In maternity hospital practice, with the protection of sterile rubber gloves and an aseptic confinement room, the author removes such retained membranes. If only a third or a half of the membranes is left, providing there is no hemorrhage, the removal of the missing portion

of itself, or until the attendant can prepare the patient, his instruments, gauze, etc., for effective hemostasis.

Second, ergot, a dram of the fluidextract, is administered by mouth, and in urgent cases a hypodermic of the same is given, followed by one of pituitrin. The best place to inject is deeply into the outer muscles of the thigh, and an aseptic ergot, coming in little glass bulbs, is employed. In no instance should the accoucheur wait for the action of the drugs, which may be absent, or at least delayed five to thirty minutes, during which time the woman may die. Experience has



FIG. 719.—PACKING THE UTERUS WITH THE HANDS ALONE.  
The thumb pushes up the gauze for the fingers to pack.

proved that it is not wise to give ergot until the placenta has left the contracting portion of the uterus.

The next procedure (third) is the hot uterine douche. The douche-bag should be prepared in every labor, and should be hung near the bed, properly protected against contamination. The patient is brought across the bed with the hips well over the edge; the parts are sterilized, and everything is arranged as for manual removal of the placenta; one hand is inserted into the uterus, and, aided by the outside hand, all clots, membranes, and shreds gently wiped out, after which the douche nozzle is introduced into the uterus and one quart of hot ( $120^{\circ}$  F.) 0.5 per cent. lysol

solution allowed to flow through. All air should be evacuated from the douche-tube before its insertion. The danger of air-embolism is emphasized by most authors. Experiments on horses and dogs have shown that immense quantities of air can be injected into their veins, with the production of only mild and transient symptoms. In the human, however, clinical experience furnishes many examples of severe collapse and death from the admission of air to the veins.

Some authors advise cold or even iced water instead of hot for the douche. The hot water is better because it is easier to obtain than sterile cold water; it does not shock an already weakened woman, and it is just as efficient. Sterile vinegar and lemon-juice have been added to the douche or used alone. In the great majority of cases the above treatment will suffice to stop the hemorrhage.

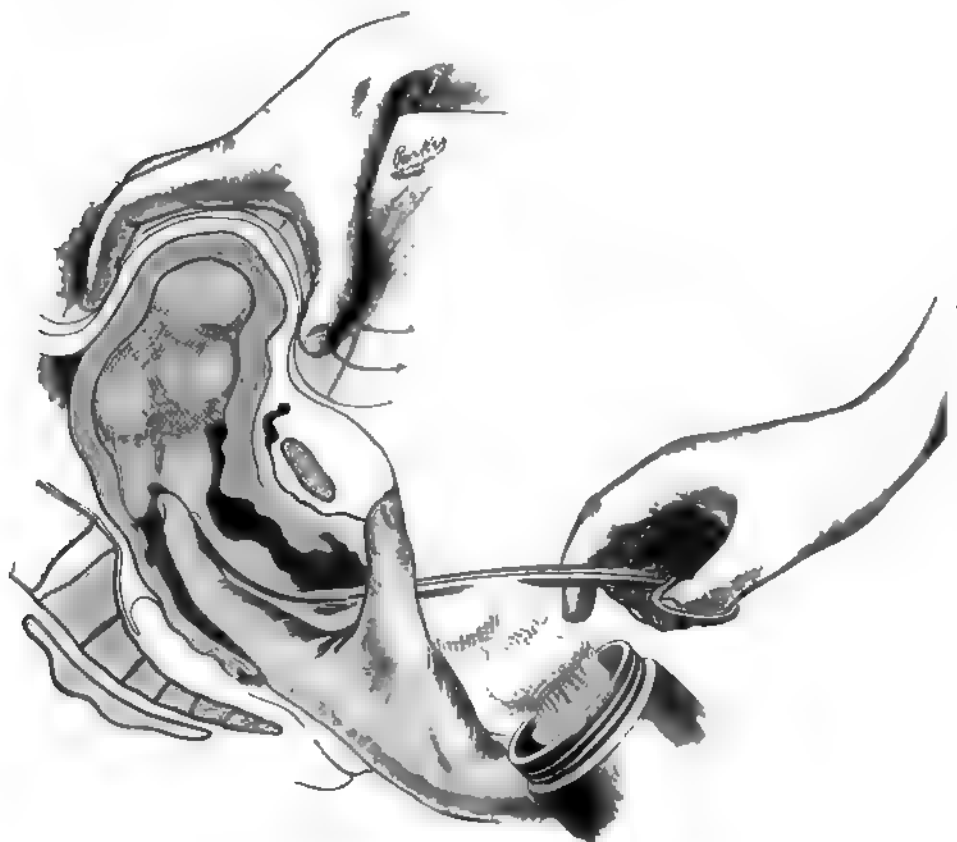


FIG. 720.—PACKING UTERUS WITH LONG FORCEPS.  
Hand as a directing speculum, assistant outside steadies fundus.

pletely. If it does not, one has to do with an extensive laceration or a bad case of atony of the uterus. The laceration, of course, will have been discovered when the hand was inserted either for removal of the placenta or preliminary to the douche. Treatment of lacerations naturally occurs at this point, but we will leave the discussion until later. Should the diagnosis of severe inertia be made, one has to adopt other measures. Time is an element in such cases. Give the uterus a little time and it will contract, but one must not allow the bleeding to continue all the while. To stop the hemorrhage and to give the uterus this opportunity, *do not compress the uterus between the two hands, as in Fig. 718. The cervix is grasped by the whole hand and folded together, while the outside hand forces the uterus down firmly against the pubis and inside hand. One may feel the uterus gradually*

returning its normal shape and consistence, and when, after ten or fifteen minutes, the pressure is relaxed, the physician finds that the flow has ceased, he may remove his hands. Should the flow continue in spite of this maneuver, or should it recommence after he has removed his hands, no further time and blood should be wasted, but the uterovaginal tract should be packed (fifth).

**Uterine Tamponade.**—One may tampon the uterus with gauze, using the hands alone, or with the single aid of the uterine packing forceps, or by sight, having drawn the uterus down with

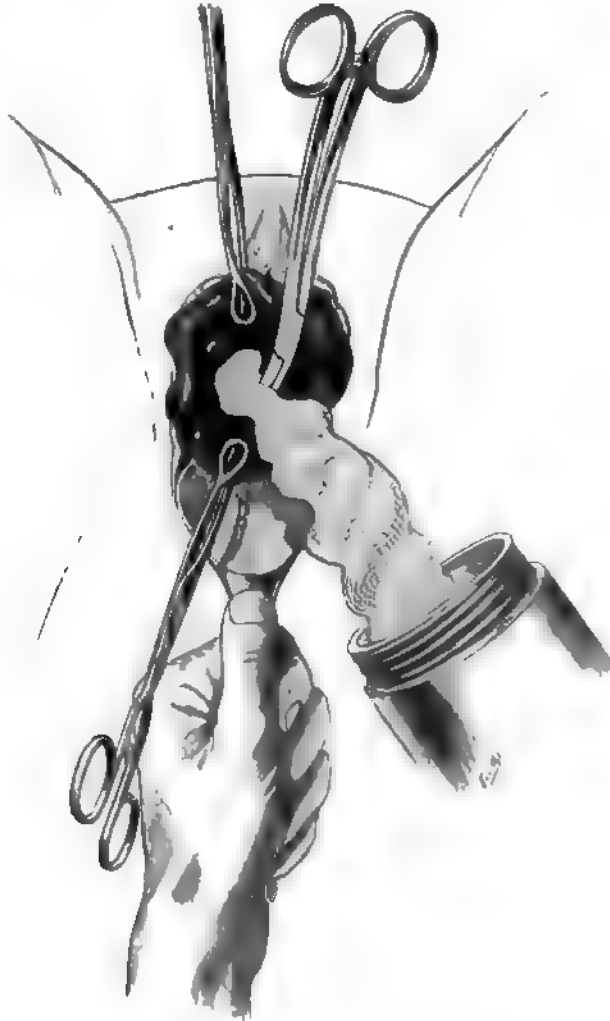


FIG. 721.—PACKING UTERUS—INSTRUMENTAL.

Two cervix forceps pull the uterus down and straighten it. The assistant's hand should control the fundus to make sure that the gauze enters it.

the vulsellum forceps and spread the genitals by specula. The kind of gauze is very important and the author recommends a  $\frac{1}{2}$  per cent. lysol gauze, whose method of preparation is described in his *Obstetrics for Nurses*.

Most often it will be necessary to operate with insufficient help, and then the second method is employed (Fig. 720). The operator puts the left hand into the vagina, the fingers inside the uterus as high as possible. Anesthesia is not usually required.

With long uterine packing forceps the end of the strip is carried up to the top of the uterus, taking care that the tip of the forceps does not catch on the contraction ring or in a fold of the relaxed uterine wall. A sterile towel is laid on the belly, and with his right hand the operator determines that the tip of the forceps carrying the gauze is really in the highest point of the uterus. The gauze is then evenly packed into the uterine cavity, from side to side, and from above down-

must be prepared to pack again; but the author has never found it necessary in cases of atony. (For further details and history of uterovaginal tamponade reader is referred to my article in the American Journal of Obstetrics, 1904, No. 4.)

To sum up briefly the treatment of atonic postpartum hemorrhage: If the placenta is in the uterus, massage; failing this, expression of the placenta; failing this, manual removal. Second, after placenta is out, massage, hypophysin, hot uterine douche with cleansing of uterine cavity, compress the uterus in ante flexion; failing all these, uterine tamponade.

Many other methods have been proposed, and occasionally they will prove useful. Compression of the abdominal aorta may be employed as a temporary expedient until one can resort to more permanent measures. Packing the vagina with a ball of gauze, a towel, or a sterile cloth that is near at hand, and pressing the uterus against this from the outside, may be



FIG. 724.—MOMBURG'S TECHNIQUE. DRAWN FROM LIFE.

Two or three turns are laid and drawn tightly enough to cause the disappearance of the femoral pulse.

flow until the accoucheur can procure a hot douche or gauze for packing. Squeezing a sponge soaked in vinegar or lemon-juice in the uterus has already been mentioned. These fluids must be sterile.

Fritsch recommended pulling the fundus forward over the pubis and filling up the space between it and the promontory with towels, after which one was to put on a very tight abdominal binder. The uterus has been folded together from the side, twisted on its axis, turned inside out, etc. Chlorid of iron and Monsell's solution have been injected, and even packed the uterus on gauze. This is unqualifiedly condemned, because harmful and unnecessary. The use of packing might be saturated with sterile and non-toxic gelatin, or with sterile blood of the husband or relative, the idea being to supply the missing thrombokinase. Suprarenal has been found powerless to cause uterine contractions unless injected directly into the uterine muscle. Suggested by Neu. At the operation of cesarean section I have seen strong contraction of the fundus at once, the intramuscular injection of 1 c.c. of either 1:10,000 adrenalin or pituitrin has been found efficacious in atony of the uterus when given hypodermically. In appropriate cases should be injected directly into the uterine muscle through the abdominal



Parsenow recommended pulling the cervix down to the vulva with vulsellum forceps, thus stretching and kinking the uterine vessels, and Henkel advised placing a bullet forceps temporarily on the uterine vessels at the sides of the uterus through the lateral fornices. Henkel's maneuver is not entirely safe, and has been seldom used, but Parsenow's is safe and may control the bleeding more or less until the uterus may be packed.

Momburg proposed circular constriction of the waist with a rubber tube, to cut off the circulation in the lower half of the body, which he had used successfully in surgery. La Torre had mentioned this as early as 1875. Fig. 724 shows the belt applied. By constricting the aorta hemorrhage is stopped, and the sudden anemisation of the uterus stimulates it to strong contraction. Sigwart reports 24 successful cases, and because of its apparent safety even recommends the procedure for midwives. In the *Revue de Chirurgie* for May, 1910, a death from heart paralysis on the removal of the belt is reported, and reference made to gangrene of the thigh, intestinal and pulmonary hemorrhage, and a possible death noted by deBovis. Buck reports a case of gangrene of the intestine, and Pagenstecher one of ischemic paralysis of the distal end of the spinal cord. Latest experience with the belt shows that it may not be used in cases of disease of

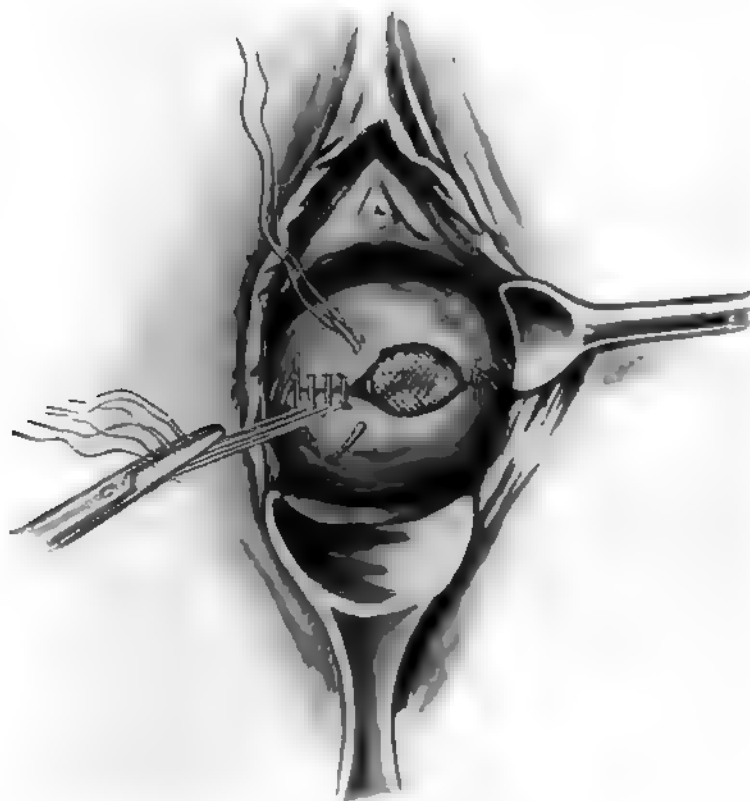


FIG. 725.—UTERUS BEING CLOSED OVER A PLUG.

The first half of the wound on both sides is closed with continuous catgut, the middle part with silkworm-gut sutures, which are removed in twenty-four to thirty-six hours.

the heart, blood-vessels, kidneys, or intestines, nor in Basedow's. In severe anemia it is dangerous unless the limbs are tied with an Esmarch before application of the constriction. The constrictor is applied with the body slanting, to allow the intestines to gravitate toward the diaphragm. As soon as possible after the bleeding has been definitely stopped it is removed. Before removing the belt salt solution is to be given hypodermically. The Esmarch bandages should be removed one at a time, leaving an interval of ten minutes, and the limbs should be kept elevated until the volume of blood is such that the heart will not "pump empty." To substitute the belt, Rissmann invented an aortic clamp similar to the tonsil compressor. (See Adair.)

**Operating in Shock.**—The consultant sometimes finds a woman in deep shock after delivery: a history of hemorrhage being given. Here delicate points at once present themselves for decision: (1) Has the bleeding stopped at the source? (2) Is the bleeding actually going on internally? (3) Will the slight oozing cease of itself, and, if so, before the state of the patient becomes precarious? (4) Will the necessary blood loss attending the manipulations required turn the delicate scale against the woman? (5) Which is more dangerous, expectancy or interference? (6) Is the state of shock due solely to loss of blood? (7) Could the patient stand an anesthetic? (8) Would stimulation start the hemorrhage anew?

Lack of space forbids a full consideration of these critical situations, the solution of which depends on individual experience and judgment. A few bits of general advice may be helpful: It is best not to operate in shock, but if the bleeding continues, operation is the lesser danger. Avoid anesthetics if at all possible. Give  $\frac{1}{4}$  grain morphin hypodermically instead. Operate in the exaggerated Trendelenburg position or have two assistants hold the patient inverted.

Have everything ready for rapid work, gauze for packing, the needles threaded, etc. Start the salt solution or the blood transfusion at once, letting it continue while the operation is being finished.

Be very deliberate in deciding to operate, but have preparations started while deliberating, and, if operation is decided upon, do things quickly and thoroughly.

### TREATMENT OF LACERATIONS

When a tear of the parturient canal has been discovered, the treatment of the case must be modified somewhat. If you compress a clitoris, vulvar or lower vaginal tear for a few minutes, very often the bleeding will cease and the regular conduct of the third stage will not need to be altered. If compression does not suffice, a few sutures will always do so.

Higher vaginal tears and cervix tears, especially in placenta prævia, may cause most serious hemorrhage. It is important to get rid of the placenta at once and get contraction and retraction of the uterus. This part of the treatment is the same as for atony. If the bleeding continues, two courses are open—one, utero-vaginal tamponade, the other, suture of the laceration. One may combine the two procedures. Without doubt the best way to stop hemorrhage from a laceration is to sew up the tear, but it may be impossible to do this because of lack of proper preparations, of assistants, light, or skill. Then, too, sometimes the bleeding is so profuse that you cannot see where to place the stitches, the whole field being a lake of blood. It may also be inadvisable to sew up the tear because of sepsis, or because the facilities are not at hand for aseptic work. It may thus be safer to leave the wound open for drainage. In such cases the tampon will be indicated, but it is not so certain a remedy as in atony of the uterus.

When plugging a uterus and tear, the operator must be careful not to enlarge the latter by pushing in too much gauze, and the whole parturient canal must always be snugly and smoothly filled, never the vagina alone.

Lacerations are sewed as shown in Fig. 689, and Fig. 687, p. 760. Free, perhaps torrential, bleeding may render such operations difficult, and I have found the following measures useful, to enable me to see the field. Compression of the aorta (now, perhaps, Momburg tourniquet); traction on the lips of the cervix with cervix forceps; packing one side of the cervix tear while the other is sutured; compression of the bleeding surface with a large wad of dry cotton or the hand for twenty minutes; Henkel's method of clamping the bases of the broad ligament with bullet forceps; filling the uterus tight full of gauze, and sewing the cervix together over the plug (Fig. 725). Occasionally a spurting vessel may be clamped and ligated.

**After-treatment.**—All danger is not past when the hemorrhage has been stopped. The patient may die from the loss of blood. Unless one has plenty of medical aids, this part of the treatment will have to be left until the accoucheur has stopped the active hemorrhage. This is the advantage of doing obstetrics in a hospital—while stopping the loss of blood an interne may be filling the patient's vessels with salt solution or blood transfusion may be done.

**During** obstetric operations in general, and the treatment of hemorrhage in particular, the patient should be kept covered and warm. After a hemorrhage has been stopped the patient should be warmly covered in bed and surrounded by bottles. If she is in much shock, the foot of the bed should be elevated at the head, and a hypodermic injection of camphorated oil given. To tide the patient over a fainting spell give a hypodermic of aromatic spirits of ammonia, and some smelling salts. While doing these things saline solution for sub-

ous administration should be prepared. Sterile salt in 2-dram vials should be in the obstetric satchel. A douche-bag, a bath-thermometer, and salt solution should be boiled. Two drams of sterile salt are placed in the bag; the tube, armed with the needle, is also put in the bag; then one quart of water is poured on the salt. The mouth of the bag is stopped with a large sterile cotton, and the bag is held under the cold-water tap or in a dish-pan of water until the thermometer registers 115° F. (Fig. 726).

The skin under the breasts is painted with tincture of iodine, and the needle, the solution flowing, is put in below the mammary gland. The accoucheur directs the needle into the connective tissue under the glandular portion of the breast. The bag is now raised 4 feet. As much as 32 ounces may run under the skin. It is advisable to lower the bag occasionally to prevent overstretching and to open up of the lymph-spaces. If the case is critical, the other side, as the two flanks, may be injected. In one patient I injected 116 ounces of solution in one sitting, using the 4 points named. The patient recovered. The patient also absorbed 2 quarts from the rectum. Such immense quantities are needed. Shall you inject the salt solution while the hemorrhage is still going on, subcutaneously, not intravenously. The blood lost then will not be pure, mixed with salt solution, and it is not so precious. By the time a quart has been absorbed the accoucheur must have the hemorrhage in his control, or the patient will have died. Some authors advise against the use of saline solution until the flow has ceased. I think their objections are theoretic. Without doubt salt solution has saved many lives. Its stimulation may last too short a time because it quickly leaves the blood-vessels. To avoid this, Rous-Wilson recommends the intravenous injection of 5 to 7 per cent. gum acacia in salt solution (Rous-Wilson).

The writer has never seen fit to bandage the limbs—so-called autotransfusion. The position of the body, with the foot of the bed raised, aided by saline solution, is sufficient.

For the rectum, salt solution, with perhaps a few ounces of coffee, is quickly absorbed, and a quart may be administered every three hours.

It is not wise to administer it per rectum until the hemorrhage has been perfectly stopped, because if any local treatment is to be carried out, the discharge from the rectum may infect the field, the hands, the instruments, gauze, etc., so that sepsis may be the direct result. One of the most unwelcome incidents in any obstetric operation is a flow of liquid feces from the anus,

and the writer is certain that this has caused infection and death many times.

Lower transfused human blood in 1666, but although the operation has been repeated many times since, success has not been obtained until recently, and there are several very good methods. From my experience with transfusion in ill newborn infants I would say that in desperate cases of postpartum hemorrhage the woman's empty vessels should be filled with blood from her husband or near relative, if healthy, of course.



FIG. 726.—COOLING THE PREPARED SALINE SOLUTION UNDER THE COLD-WATER TAP.

enlarged piecemeal, with fetid discharge and fever, sometimes with hemorrhages, and a pyemia may ensue.

Subinvolution stands next in frequency, the large boggy uterus bleeding on the slightest provocation. Low grades of infection are responsible for many cases of subinvolution. Displacements of the uterus are usually part of the same process, and in retroflexion of the puerperal uterus hemorrhages are not infrequent and prolonged, and bloody lochia—in some cases for six or eight weeks—are very common. Favored by subinvolution and displaced by a full bladder or rectum, the uterus may bleed, and a disquieting degree of anemia may result.

Nervous influences unquestionably play a rôle. I saw a very serious hemorrhage result from relaxation of the uterus on the eleventh day when the puerpera had been frightened by a domestic quarrel. We know that the menses may cease, and that metrorrhagia may ensue, upon a nervous shock.

Sudden physical strain often causes a reappearance of the bloody lochia, as is so often observed when the puerpera gets up for the first time. Severe hemorrhages at this time are rare, but do occur (subinvolution).

As occasional causes may be mentioned myomata, especially the mural and submucous varieties, carcinomata, cervical erosions, ulceration of a cervical vessel, rupture of a small uterine or cervical hematoma, aneurysm of the uterine artery, inversion of the uterus, chorio-epithelioma, secondary hemorrhages after suture of a cervical tear, as occurs sometimes after gynecologic operations, traumatism from coitus, sometimes with rupture of the vagina, and puerperal septicemia with softening of the thrombi of the placental site. The last form of hemorrhage is very fatal.

**Diagnosis.**—Three points must be settled—first, is there anything in the uterus? second, is it simply a case of relaxation or subinvolution? third, is there a neoplasm?

Early in the puerperium a vaginal examination is forbidden unless urgently indicated, but a rectal exploration, combined with the external hand, gives nearly as much information and is quite safe. Later in the puerperium, after the fourteenth day, a vaginal examination may be made. If the cervix is too soft, patulous, and the uterus large and globular, a retained cotyledon of the placenta may be suspected. Sometimes it may be felt through the open cervical canal. If the uterus is evenly enlarged, of a soft, doughy consistence, but the cervix not admitting the finger, subinvolution is probably present, and by massage it may be possible to get the organ to contract. Between placental polyp and partial inversion of the uterus the combined manipulation must decide, and it is usually easy if the latter condition is thought of.

**Prognosis.**—Even though severe, the hemorrhage is seldom fatal, and it responds quickly to treatment. The most dangerous are the cases of placental polyp, the frequently repeated hemorrhages depressing the puerpera a great deal, and especially critical are the infected placental fragments, because if it is necessary to remove them, the unavoidable manipulations grind the infection into the placental site, into the open veins, and into the thrombi here, pyemia easily resulting.

**Treatment.**—Early in the puerperium it is dangerous to submit the patient to active local treatment, especially if she has fever. A mild infection may thus be changed to a fatal one. Therefore external remedies are at first to be tried. Ergot and hydrastis internally, pituitrin, hypodermically 1 c.c. every six hours, massage of the uterus, and the ice-bag or a hot vaginal douche may be ordered. If the hemorrhage persists, the uterovaginal tract may be packed with slightly antiseptic gauze. This will care for a hemorrhage from atony as well as one from the retention of a piece of placenta—indeed, it favors the separation and expulsion of the latter. Manual or instrumental curetage is not to be performed in the early puerperium. It is best to temporize, if possible, using occasional tamponade, rest, medicine, etc., until the fifth or sixth week of the puerperium, by which time involution is so well along that the uterine muscle will not be easily perforated, and the blood-vessels so tightly

thrombosed that the finger or the curet will not be able to carry infection into them. I have seen two fatal infections result from neglect of this advice. Should the indication to remove the mass be positive, the placental forceps and the finger are to be used, not the curet; an antiseptic uterine douche precedes, and a weakly antiseptic uterine pack completes the operation.

A retroverted uterus is to be replaced by posture or the colpeurynter, not by the fingers, early in the puerperium. Later a pessary may be applied. Myomata, cancer, erosions, etc., are treated on general principles. Temporary tamponade of the vagina may tide the patient along until the best time for operating arrives. In non-operative cases the injection of human blood intramuscularly sometimes effects a cure.

#### SYNCOPE AND SUDDEN DEATH IN LABOR

A gravida, a parturient, or a puerpera may collapse and die suddenly, the cause being sometimes determinable only at the autopsy. Often, however, the complication may be expected, knowing previous disease to exist. Only a partial enumeration of the causes may here be attempted, otherwise we would have to cover the entire field of medicine. The causes may be divided into—(a) Those which may be properly said to accompany the puerperal state; and (b) those which are extragenital, but in which the performance of the reproductive function is the exciting factor. (See E. P. Davis.)

A. (1) Sudden collapse and death may be due to hemorrhage and shock from any of the obstetric accidents already discussed, for example, ruptured ectopic gestation, placenta prævia, abruptio placenta, rupture of the uterus, postpartum hemorrhage, inversio uteri, rupture of the pelvic joints, rupture of a varix in the broad ligament.

(2) The acute toxemias which go with the pregnant state, the prostration and collapse of hyperemesis gravidarum, the toxemia of eclampsia, of pernicious anemia, uremia (Strümpell, Bartels), and those of sepsis. Almost fatal syncope from acute uremia or from acute pregnancy toxemia, with characteristic urinary findings, I have observed twice. Zweifel reported such a case, confirmed at autopsy, and Norris another. Eclamptic toxemia may cause sudden death by cerebral hemorrhage, and this may occur when the convulsions and other signs of the disease are absent. Syncopal attacks in severe sepsis, due to passing cardiac weakness, are common, and the end in such cases is often due to paralysis of the heart, which may come on suddenly.

(3) Pulmonary embolism is an often mentioned cause, the clot usually being found plugging one or more of the pulmonary arteries. The embolus almost always comes from the thrombosed veins in the pelvis or thigh. Slowing of the circulation in the veins allows the blood-platelets to accumulate on the wall and build a white thrombus, on which the red clot will always be found. Alteration of the blood may predispose to thrombus formation, especially if the vessel-wall is injured. It is possible that clots may form in the large veins of the thigh if the limbs are held in a cramped position for a long time, as in protracted operations with the patient in the exaggerated lithotomy or Trendelenburg positions. Puerperal infection acts in two ways, first, by an alteration of the blood, predisposing to thrombi distant from the site of the disease, and second the infection may spread along the veins or to the veins, directly causing thrombosis. Although most authors emphasize the mechanical factors, the precipitation, the agglutination, etc., I have never seen a thrombosis where infection, either endogenic or exogenic, could be ruled out. Veit believes the same. Angus McLean experimentally proved that thrombosis and embolism could not be produced in animals without infection. Thrombosis may follow as the direct result of an intestinal infection. In cases of severe anemia

profound shock, the circulation in the heart being almost in abeyance, a clot forms, and, after a few days of only partial recovery, sudden death from cardiac lysis may occur. Pus from a pelvic abscess may break into a vein and reach the heart.

Air-embolism has frequently been given as a cause of sudden death in pregnancy and labor. A colleague of the author told of a woman, pregnant four months, who, while taking a douche with a bulb syringe, died suddenly from this cause. Such deaths have been reported from attempts to produce abortion by injecting air into the uterus. During obstetric operations, especially with placenta previa, the accident has time and again occurred. Curiously enough, experiments on animals have shown that enormous quantities of air can be injected into the veins going directly to the heart, without any, or quickly passing, bad symptoms (Fitz-ick). In the human, however, the danger of the admission of air into the veins through the uterine sinuses is a well-established fact. During the operation of the tamponade in placenta prævia the author had one case of collapse from air-embolism (recovery). In personal communications Dr. Skeel and Dr. Bogardus report two others, one of which was fatal. Vavra reports a fatal one. Gases of decomposition which accumulate in the uterus may gain entrance to the veins. The terium *aërogenes capsulatus* has been found in these cases, and the presence of these gases may bring the diagnosis into question.

(4) The nervous shock of labor may cause syncope and even death, and a psychic shock at the time of labor may be fatal. In the First Book of Samuel, Ch. 9, 20, it is said that Eli's daughter, learning that her husband and father-in-law were killed and the ark of God taken, went into labor and died. Hirst tells of a woman, illegitimately pregnant, who, on being shown the child, went into delirium and died. Sue (*Histoire des Accouchements*) relates that a pregnant woman was told by a gypsy that she would die in labor. She made her will and expired. Wilson had a similar experience, but, by giving morphin, he put the woman asleep, during which time she forgot her obsession. That profound nervous influences can produce postpartum hemorrhage I am convinced from actual experience. Acute syncope in labor, the result of excessive pain in a nervously disposed individual, may be an indication for the termination of labor. Loss of consciousness may occur during the second stage, the result of intense pain, and the child may be delivered without the knowledge of the mother. I have observed this myself, and agree with others that in medicolegal cases cognizance should be taken of it as a fact—for example, in cases where a mother, bearing alone, is accused of infanticide. Syncope during delivery, in the absence of hemorrhage, rupture of the uterus, etc., is very common and may be due to nervous or physical shock in susceptible individuals. I have seen syncope follow the delivery of the child in a case where the woman had been endeavored to breathe very rapidly and deeply with a view of preventing her making her own efforts, the object of the same being to keep the child back until the midwife could get to the bedside. This phenomenon is probably an asphyxia.

Distention on the uterine ligaments by forced delivery through an unprepared parietal canal may produce peritoneal shock. I have seen the same during the removal of gauze used for packing. Sudden loosening of a Momburg belt may be followed by syncope. Pituitrin sometimes causes stenocardial attacks.

Anderson and Rosenau try to find a connection between the admixture of fetal maternal blood and eclampsia, a sort of anaphylaxis. While the idea is not adopted for eclampsia, some cases of collapse and sudden death postpartum resemble in forms of anaphylaxis. The status thymicus has not been studied in this connection. Disturbances of the pluriglandular system—hypo-epinephrinemia may explain some cases, then this disturbance must be explained.

Acute dilatation of even a normal heart may occur at the end of a protracted second stage, with exhaustive bearing-down efforts.

from a few hours to twelve days after delivery. Infection of the liver, with delirium, coma, jaundice, and acute, terminating fatally within twelve hours (acute pyemia). Treatment is on general lines, and depends on the cause.

Trendelenburg, for pulmonary embolism, adrenalectomy and extraction of the clot. Four cases Klein states two might possibly have been saved.

An attempt should be made to prevent air-embolism. While packing the uterus a large vessel may be torn. Sometimes the chance must be taken. Phlebitis, see page 886.

#### DELIVERY OF THE FETUS POSTMORTEM

About 100 cases of spontaneous delivery of the fetus on record. The expulsion of the fetus, which may be at once or after days, depending on the cause, is usually produced in the intestines, but it may be accomplished even by contractions of the uterus postmortem. In some cases, before death, and the parts were thus prepared for delivery. Of interest of these cases, they are important in a medical and legal point of view. The accoucheur may be accused of criminal neglect, if he fails to bury the woman alive. (See Reiman.)

#### INFECTION DURING LABOR

A temperature of 100° to 100.6° F. may frequently occur during the second stage of labor. It is usually ascribed to absorption of fibrin ferment, excitement, etc., but the absorption of toxins and bacteria from the parturient during labor may be carried over from the pregnancy, or it may result from instrumental interference, etc., or it may be purely endogenic from the blood or from the membranes, salpingitis, ureteropyelitis. If the membranes are ruptured, bacteria may wander upward. Warnekros has shown that bacteria from the interior of the uterus may pass through the membranes and placenta. Slemmons was the first to show that bacteria may pass through broken amniotic epithelium.

The symptoms of infection during labor are usually those of sepsis. The child is endangered; it, too, may become infected. The infection thus conveyed, also gonorrhea, is usually discolored and odorous, depending on the cause. Pus may issue from the introitus and cervix are often inflamed, but unless delivery is soon accomplished, gangrene of the perineum may result.

**Treatment.**—If the uterovaginal canal is preoperatively infected, it should be disinfected at once. If not, the accoucheur may wait for the danger of making extensive injuries to be ground. The greatest danger exists in the case of the spontaneous term delivery. It is wiser to wait the spontaneous term delivery down onto the perineum, interfering only when necessary. May be useful here. Before operation the p

with 0.75 per cent. solution of tincture of iodine. It is my practice in such cases not to suture lacerations, but to leave them wide open for drainage. I often pack the whole parturient canal lightly with 0.5 per cent. lysolized gauze. Some authors advise not to put the hand up into the uterus, since this may carry the infection to the placental site, advice which may be heeded if the conditions of the case are favorable. A chill with sharp rise of temperature often follows operation, but the fever usually subsides in twelve hours unless the streptococcus was causative. Bacteria demonstrated in the blood during and directly after labor usually disappear within thirty-six hours.

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## CHAPTER LXII

### ACCIDENTS TO THE CHILD

IDEAL obstetrics demands that every child not congenitally deformed be delivered alive and absolutely uninjured. This ideal is far from being realized. Statistics show that over 4 per cent. of the children die during birth. Schultze, in 1877, estimated that 5 per cent. of children are still-born, and 1.5 per cent. die very shortly after birth, the result of the trauma of labor (Thomas). Holt, and Babbitt found 4 per cent. of still-births in 9747 viable children at Sloane Maternity, New York, and Kerness, 5.2 per cent. at the Munich Frauenklinik. Some confusion exists regarding the definition of "still-birth." Ballantyne suggests that the term be applied to a child born "still," but with discoverable signs of life, and that "dead-born" be applied to those in whom life is actually extinct. According to Ballantyne some still-born children may be saved. The majority of authors hold still-born and dead-born to be identical, which appears to me the simplest way. A large percentage—how large it is impossible to say—is more or less injured, and this, too, in so-called normal delivery. Any one performing autopsies on newborn children will be struck by the frequency of hemorrhages, punctate and larger, in the brain, in the larger ganglia, along the sinuses and the sutures. It is certain that such extravasations leave scars, perhaps minute, in the cerebral structures, which may explain some cerebral symptoms later in life.

The greatest danger which besets the child on its way into the world is the interruption of its respiratory function. It often comes in a condition of partial or complete anaërosis. The old and universally used term to express this state is "asphyxia," but this is etymologically incorrect, because it means "without pulse" (from *σφύξις*), and the children are not so at all—the pulse being the last to disappear. Numerous terms have been suggested to take the place of the generally and long-recognized inappropriate "asphyxia," such as dysapnea, euapnea, ecchysis, pneumocardia, anhematosis. The one here suggested by the author, anaërosis, from *α*, privative, *ἀήρ*, air, and *-osis*, the condition of, expresses the state of the child and covers practically all the causes. In the succeeding pages the two terms, anaërosis and asphyxia, and their derivatives, will be used synonymously, or as indicating that the former leads to the latter.

### ASPHYXIA NEONATORUM

As pregnancy nears the end the fetus' blood becomes more and more venous, which is due to the gradual narrowing of the ductus Botalli and ductus Arantii. It is generally said that the fetus cannot stand a sudden increase of this venosity as well at term as earlier in pregnancy, but my own experience does not confirm such a statement. From Hippocrates' time a popular notion has prevailed that seventh month babies are more likely to live than those of the eighth month, and probably this idea is founded on the possible greater tolerance of asphyxia by fetuses of the earlier months of pregnancy.

The child exists in a state of apnea, that is, without respiration, because it has not enough oxygen for its wants. Observation of the fetus at cesarean sections, and of a foot or arm in the intact bag of waters, shows a slight bluish tint of the skin, which would indicate that there is a slight increase of CO<sub>2</sub> over that of the delivered child. The fetus, therefore, is not in a state of acapnia. During labor there is a gradually increasing anaërosis, which reaches its acme just as the head is expelled

through the vulva. With each pain there is a slight retardation of the maternal blood-current through the placenta, and at the same time a very slight increase of pressure on the fetal head, if the latter has already entered the pelvis. After the bag of waters has ruptured both conditions are more marked, and as the head passes the vulva the greatest change takes place, that is, the head suffers the greatest pressure, the uterus contracts the hardest, forcing the maternal blood out of its meshes, and, in addition, the placental site undergoes slight reduction in size and there may be some detachment of the placenta. All these factors have a positive, sometimes marked, influence on the child. In the first stage of labor they usually cause a slight slowing of the fetal pulse. Seitz finds the opposite—a slight increase of rapidity. In the second stage the slowing is the rule, and at the very end it is invariable, a fact easily proved by palpating the chest of the child still in the vagina, or the cord directly after birth. When born, the child is in a state of slight anaërosis, or if the second stage was not prolonged, only apneic. As a result of the slight pressure which the head undergoes the blood is forced out of the head, and a moderate degree of anemia of the base of the brain, the medulla included, ensues. The slowing of the maternal blood-stream and the changes at the placental site cause a mild deoxidation and hypercarbonization of the fetal blood, and the anemia of the medulla accentuates the general lack of oxygen. Together the result is that the cardiac and respiratory centers in the medulla do not receive good blood. Since the respiratory center is naturally torpid, almost inactive, it responds very slowly and late to this condition, but the cardiac center, the origin of the vagus, the pneumogastric, is very sensitive, and the deoxygenated and hypercarbonized blood stimulates it to action. The same is true of the vasomotor centers. The heart is depressed, the pulse is slowed, and the blood-pressure slightly raised. Whether it is the lack of oxygen or the excess of  $\text{CO}_2$  which irritates the vagus center and slows the pulse was much discussed. Later experiments seem to prove that it is the excess of  $\text{CO}_2$ . If the anaërosis is acute, the stimulation of the vagus center is strong, the heart is very much slowed, and the asphyxia is increased.

Now the respiratory center awakens and elicits spasmodic contraction of the muscles of respiration. The fetus gasps, and whatever lies near its mouth is sucked into the lungs—liquor amnii, vernix caseosa, meconium, blood, vaginal mucus, feces, etc. This inspiration also dilates the capillaries of the lungs, and unless there is something in the alveoli (air) to exert counterpressure, some of the capillaries may burst. As a fact, smaller and larger hemorrhages in the lungs and pleuræ are the rule in cases of asphyxiation. If the loss of oxygen and increase of  $\text{CO}_2$  are very slow, the respiratory center may be benumbed and the fetus may die without having made any attempt at respiration. These cases offer a bad prognosis, even if the child is delivered with the heart still beating. The continued stimulation of the vagus center results finally in its paralysis, its inhibitory action is gone, the pulse jumps to 180 to 200 or more. Sometimes the fetal heart becomes irregular, a few powerful beats succeeding a run of weak, almost uncountable pulsations. In other cases of threatened intra-uterine asphyxia the fetal heart-tones are very rapid from start—180 to 210. It is possible that such frequencies are preceded by slowing of pulse, though in several cases in which the heart-tones were carefully noted later was not observed. It is hard to explain the primary acceleration of the pulse, though perhaps cerebral compression may do it (Schröder). Why compression of the brain should slow the heart in one instance and hurry it in another is not clear. Direct irritation of the cortex can stimulate the cardiac and respiratory centers, and peripheral irritants may act likewise. It is possible that some of the peculiar phenomena observed during labor may be explained in this way.

**Pathology.**—Death of the fetus during pregnancy may be due to a great variety of causes, though interference with the function of respiration is found in the last nearly all of them. All the acute infectious diseases, especially if complicated by high fever; chronic infections, syphilis, tuberculosis; poisoning by

amptic, uremic, or other toxemic poisons, by chemicals, morphin, phosphorus, etc., asphyxia and anemia of the mother; injuries to the fetus by stab or blow, congenital deformities; diseases of the fetus itself, as infection, leukemia, sarcomatosis, Buhl's disease, heart and abdominal affections; all these and more like them may be found. Sudden nervous shock to the mother may kill the child in a manner not yet explained.

During labor the causes of fetal anaërosis may be divided into two classes: (1) Those which directly cut off the supply of oxygen (suffocative), (2) those which use compression of the brain (paralytic).

1. *Those Cutting Off Oxygen Supply—Suffocative Asphyxia.*—(a) Prolonged and hard labor pains, recurring so frequently that the blood in the placental sinuses cannot be renewed, are the most common factor. This is observed at the end of the second stage, with rigid pelvic floor, in contracted pelvis, with tetanus uteri, and, but rarely nowadays, with the use of ergot. Pituitrin occasionally acts this way. The general mortality of the children in protracted labor increases in proportion to the length of labor; (b) excessive retraction of the uterus away from the child, with diminution of the placental area, and perhaps with some partial separation of the placenta, for example, neglected shoulder presentation, threatened rupture uteri; (c) compression of the placenta when it is low in the uterus, or of the insertion of the cord, either by the head or trunk, or sometimes by the collarbone; or compression of the placenta by the head when the child presents by its breech; (d) compression of the umbilical cord, either with prolapse of same or while it still lies in the uterus; coiling of cord around the neck of the child may cause anaërosis, and here, too, it is especially exposed to injurious pressure from the tip of the forceps blade; knots, rupture, hematoma of the cord; (e) partial and complete abruption of the placenta, either normally or abnormally implanted, in either head or breech presentations; (f) anemia of the child from rupture of the placental vessels (placenta prævia) or tearing of a velamentous vessel; (g) narcosis (morphin), asphyxia, anemia of the mother, the child dying first, since it gives back oxygen to the mother.

During the first few minutes after birth the child may be asphyxiated by its passages being blocked. A tight caul; the aspiration of vaginal mucus, blood, conium, or the mucus which often lies in the child's own glottis and is drawn down at the first breath; edema of the glottis and throat consecutive to face presentation; congenital atelectasis (syphilis, etc.); heart and other diseases; gross and microscopic deformities—all these have been found more or less often.

2. *Compression of the brain* brings about asphyxia in several ways, depending entirely on the manner of compression, whether internal or external. This is *paralytic asphyxia*. Internal compression from hemorrhage or fracture, as well as external pressure from a contracted pelvis or a rigid perineum, may slow the pulse and cause anaërosis, because the blood is hindered from reaching the placenta. Internal local compression of the cardiac and respiratory centers may cause asphyxia by directly paralyzing the vagus or stimulating respiratory action. The slowing of the heart from cerebral compression can be easily demonstrated during forceps operations if the accoucheur will but listen while he closes the blades of the instrument. In some cases the effect is not immediate, but it is always present when the pressure is kept up a few seconds or if it is made quite strong. Sudden and marked slowing of the beat is proof that the cord has been caught in the grasp of the blades. It is probable that in cases of cerebral compression without hemorrhage there is also an additional external cause which reduces the amount of oxygen to the fetal blood which may be found under Class 1.

Finally may be mentioned the premature respirations made by the child, the result of external stimuli, version, forceps, pulling on the leg in breech extraction, and the presence of air in the uterus. Compression of the vessels in the neck (face presentation, coiling of the cord) produces a local venous congestion of the brain.

**Pathology.**—Postmortem findings vary, of course, with the cause and the rapidity of the asphyxia. In general one finds the effects of an intense venous congestion combined with that of localized spasm of the arterioles. The auricles of the heart, the pulmonary system, the liver, and the spleen are engorged with blood. The back pressure in the veins of the lungs, pleura, pericardium, peritoneum, brain, kidneys, and suprarenals causes extravasations of blood, varying in size from a pin-head to one inch, and, particularly in the brain, immense hematmata may form. Minute hemorrhages in the retina, the ear, and in the ganglia at the base of the brain may cause serious disturbance of function if the child withstands the primary asphyxia. Serosanguineous transudations may be found in the pericardium, pleura, peritoneum, and in the brain; also edema cerebri. If respiratory movements had been made, liquor amnii, meconium, blood, etc., may be found in the lungs, parts of which are atelectatic and parts full of air. Seitz emphasizes the importance and frequency of edema of the prevesical connective tissue around the hypogastric arteries, and edema of the genitals, particularly of the scrotum. Edema of the vulva and scrotum is not rarely observed after natural labors, and Seitz says it is likewise due to asphyxia. When the umbilical cord is compressed, the back pressure is felt first in the vein and then in the arteries near the navel.

**Symptoms and Diagnosis.**—*Before Delivery of the Child.*—1. The most important, because the most reliable, external evidence of danger besetting the child in utero is a change in the fetal heart-sounds. These may be altered as to frequency, regularity, strength, and rhythm. A persistent slowing of the fetal heart to 100 beats a minute is always significant of danger, and if, during the uterine contraction, the rate goes down to 80 or less, there is no doubt about it, and delivery is demanded forthwith. As the rate sinks from the usual 140–136 to 124–112, then to 112–100, the two rates given as those between and during the pains, respectively, the accoucheur becomes more and more certain that there is some factor causing a stimulation of the vagus. At the same time the tone becomes stronger, and occasionally a little accentuation of the second sound may be distinguished. Primarily increased rapidity of the heart-tones is not so good a sign, but if the heart-tones are continuously above 175 (Winckel says 160), without fever of the mother, danger to the life of the child may be apprehended. The sudden change from slowed heart-tones to excessive rapidity denotes paralysis of the vagus center and is of very bad omen. As a rule, at this time the respiratory center awakens and elicits inspirations. Irregularity of the fetal heart is also significant. A few strong beats are followed by a run of light, short taps, and sometimes the heart may run and stumble along in a most erratic manner. This irregularity is very ominous if it follows a period of slowed action. Sometimes the rate of the heart will run from 140 to 170 without definable cause and without relation to the uterine contractions. It is wise to distrust such cases. The strength of the tone gives additional information, a slow, strong sound indicating vagus stimulation, a rapid, weak one, paralysis or general fetal weakness. If the first sound of the heart is booming, a healthy muscle may be diagnosed; if it is weak and valvular, gallop-rhythmus being present, danger exists. In general, the above findings are positive of threatening danger, but in rare instances most of them may be present and the child is born alive and well, while still more rarely the heart may show no evidences of distress and yet the infant is still-born or asphyctic. Cerebral hemorrhage may sometimes do this. Other signs of intra-uterine anaërosis will aid the accoucheur here, but he will not be much amiss if he interferes in the labor on the indication given by a study of the fetal heart-tones.

(2) The passage of liquor amnii stained with fresh meconium is a valuable sign of impending intra-uterine asphyxia. It was the only one the ancients had. The sign is of no value if the presentation is a breech, unless the latter has not neared the inlet. The passage of meconium is due to an active peristalsis set up by the anaërotic blood, and finds its analogy in the bowel movements of drowned or otherwise

asphyxiated persons. It is true that the use of quinin will cause the discharge of meconium, and that in a certain percentage of natural deliveries meconium will come away in the liquor amnii and the child will show no evidences of distress when born. My experience and Rossa's agree, that the character of the labor in these cases was such that anaërosis would be very likely to occur. While I am willing to agree that the sign does not have the absolute significance that some writers ascribe to it (Küstner), I am inclined to give it more value than does Seitz in his monograph.

Liquor amnii stained with old meconium is olive-green in color and the meconium is thoroughly mixed with it. Fresh meconium is dark sea-green and is lumpy. If such a mixture is expelled, the accoucheur should study the fetal heart-tones and the nature of the labor, and if any cause for anaërosis or any irregularity of the heart-tones is discovered, the sign becomes of positive value. In obstructed labors the passage of meconium may long precede the slowing of the heart.

If the asphyxia is fairly well established, the child makes respiratory movements and these may be seen, felt, or heard by the attendant. (3) During breech deliveries one may see and feel the diaphragm come down; during forceps operations it is often possible to feel and see the gasps of the child as jerks of the forceps or as a jarring of the lower abdomen. It may be impossible to distinguish these jerky gasps from fetal hiccup. The fetal heart-tones, the nature of the labor, and the meconium must aid in the differentiation. Unless the child can be extracted within a few minutes after it gasps it is lost, and even if delivered alive, it will very likely die within a few days from atelectasis pulmonum or cerebral hemorrhage.

*Vagitus Uterinus.*—This term has been applied to the crying of the child in utero—before it is born. Many authentic cases are on record. It is said that Mahomet and St. Bartholomew made themselves heard while in the uterus, but these probably are fables. If air is introduced into the uterine cavity alongside the hand, as in version, or with instruments, or by a simple examination, or if gases develop there, the child may inspire, and on expiration may produce a cry. Sometimes this may occur without other evidences of dyspnea, and the child may be delivered in good condition, but usually the condition is due to anaërosis, and unless the infant is at once delivered, it will suffocate. In Kristeller's case the child cried 8 different times, when the forceps were closed on its head. From a medicolegal point of view the cases of *vagitus uterinus* are very important, since the lungs may be partly inflated and the child die before birth. Finding air in the child's lungs would be no evidence against the individual accused of infanticide. Reidy reports three cases.

Other signs of threatening intra-uterine asphyxia are: (4) Very active fetal movements, felt by the mother or by the attendant, a phenomenon which occurs especially if the anaërosis is sudden, and may indicate a death-struggle or attempts to respire; (5) the persistence of a loud umbilical souffle; (6) the loss of tonus of the anus in breech cases; (7) the weakening and disappearance of the pulse in a foot or hand which may be brought down, or from the cord, which may have prolapsed. In many cases I have passed the hand into the uterus to feel the heart. (8) Pulsation of the fontanel is not discoverable, but in one case I could feel the child's heart through the thin abdominal wall.

*After Delivery.*—Cazeaux defined two degrees of asphyxia in the new-born child—*asphyxia livida* and *asphyxia pallida*. The symptoms, of course, depend on the degree of the anaërosis, and between the two states mentioned there are many gradations.

In *asphyxia livida* the child is dark blue, sometimes purplish and mottled, the face swollen and congested, the eyes somewhat prominent, and the conjunctivæ injected; the skin around the nose and mouth may be slightly pale, but the lips are deep blue. Tonus of the muscles is not lost; the arms are held up; the body is fairly rigid; the mouth closes on the finger; the throat reacts. If the face is blown upon or wet with cold water, the muscles twitch. The heart and cord pulsate slowly and strongly; there is an occasional gasp, accompanied by a gurgling sound, the mouth and bronchi being full of mucus. These are the mild cases, and they respond quickly to treatment.

In *asphyxia pallida* an entirely different aspect is presented. The child is pale and waxy, but the lips alone are blue. The body is limp, the extremities hang-

ing down without any tonus at all; the jaw drops relaxed—There are no respiratory movements, or a rare gasp which may be simply a movement of the jaw. The only evidence is a slow, or perhaps very rapid, heart-beat. This may not be audible with the stethoscope. The cord is limp and collapses at once. The criteria of this severe form of asphyxia are the loss of tonus and the loss of reflex excitability. This condition is irreversible, and even if the infant is revived, it may die later of secondarily pneumonia; areas of atelectasis exist which obstruct the flow of blood. As a result of the permanent deoxygenation of the blood which supplies the heart muscle this organ cannot function. The anaërosis also affects the nerve-centers, and the child gets no rest of the respiration, which never was adequate and was attended by spasms, becomes more and more superficial and rapid, finally ceasing to act for a while through its own automaticity, but soon after autopsy hypostatic edema is determined in addition to the asphyxia.

**Diagnosis.**—Not all children that are born in an asphyxiated state are asphyxiated. Other conditions are pressure on the brain, morphin-poisoning. Brain compression may be both the

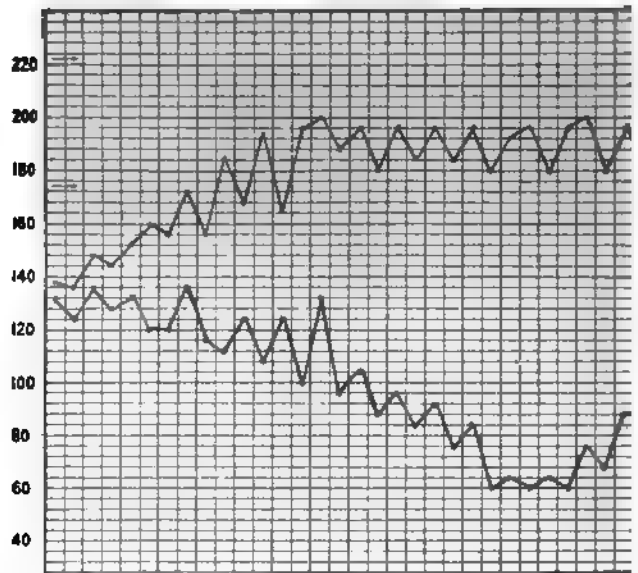


FIG. 727.—TRACINGS OF THE TWO TYPES OF HEART-TONES IN ASPHYXIA IN UTERO.

asphyxia. We have seen how it can cause asphyxia. In cases of great cerebral congestion and sometimes spasm of the arteries of the brain may burst, causing hemorrhage, which may be subarachnoid, or intraventricular. This in turn causes anaërosis.

The diagnosis of cerebral compression is not easy, and must be the guide, *e. g.*, a hard forceps or extraction, in which injuries to the skull have been made. Focal symptoms are in the early stages. In some cases of cerebral hemorrhage it is possible to go on for many hours with artificial respiration, but the infant does not breathe. The treatment must be like that of asphyxia. A case of pale asphyxia, and the diagnosis may be made on the fact that the infant suffered a loss of blood, as from tearing of the placenta or rupture of a velamentous vessel.

An apneic or oligopneic child is often called an anaërotic one, and frantic efforts are made to get it to breathe when only a few minutes' patient waiting is all that is required. Such an occurrence is frequent at cesarean section. In apnea the child looks natural, the lips are slightly cyanotic, the features are not distorted, the color is light grayish blue, the heart-beat is strong and not much slowed at first. Gradually the cyanosis deepens, the pulse slows, the child becomes anaërotic, which stimulates the respiratory center or prepares the center for the reception of the stimulus from the outside air, and the first gasp occurs, or a sneeze which removes the mucus from the air-passages. A few tiny respirations precede the gasp, and a vigorous cry follows it.

Morphin-poisoning is not rare under the use of scopolamin-morphin anesthesia and when the latter drug is given in eclampsia. The child is very quiet and limp, cyanotic, the pupils contracted, the conjunctivæ insensible, but the heart-beat is usually strong, regular, and not very slow, unless, in addition, the infant is asphyxiated. If spanked, the child opens its eyes or grimaces with pain, but does not cry or breathe. Usually there is no mucus in the air-passages. Resuscitation is at first successful: the child may be brought to cry or even to open its eyes, but it soon relaxes into somnolence and then into coma. I have kept such an infant alive for six hours until finally the heart gave out.

**Prognosis.**—It is naturally impossible to form a true estimate of the frequency and of the mortality of asphyxia neonatorum, since there is no standard by which the severity of such cases may be measured. In general it may be said that the milder and shorter the asphyxia is, the better the chances of immediate and permanent recovery are, and the severer and more prolonged it is, the more dark the prognosis. It has been found that many children die from the effects of asphyxia as late as the fourteenth day, though the greatest secondary mortality occurs within forty-eight hours. Children that have been for a long time in a state of partial anaërosis in utero,—two to six hours,—even though delivered alive, often die immediately or shortly after birth. This fact must be taken into consideration when selecting obstetric operations. Children on whom efforts of resuscitation had to be prolonged to bring them back to life also die in large numbers within a few hours or days, simply because the asphyxia was very deep and fatally damaged vital structures. Poppel, in 1865, confirmed these daily clinical experiences by statistics. Possibly some form of acidosis arises, since I have found albuminuria, coma, convulsions, and icterus in some of these cases.

Asphyxiated children are more liable to infection, to bronchopneumonia, intestinal inflammation, melæna neonatorum, icterus, hemorrhage into the parathyroids, with spasmophilia (Graham), meningitis, acute and chronic atelectasis pulmonum, and they often suffer from the effects of the anaërosis—cerebral and other hemorrhages, as well as from the injuries which sometimes are inflicted on them with too violent methods of resuscitation. These are bruises, burns, fracture of the ribs and sternum, blowing foreign matter into the lungs, rupture of viscera, etc.

Boys die from asphyxia in a greater number than girls, because they are larger and harder, causing dystocia more often. Children of primiparæ suffer from it oftener than those of multiparæ. Rigid pelvic floor causes a high infant mortality. Asphyxia, directly due to operative deliveries, and also the shock to the fetus attending the same, must always be considered. Of great interest and importance is the well-established fact that children that were asphyxiated or brain-injured during birth often suffer from severe psychic and nervous diseases later in life. Prolonged labor and operative deliveries with asphyxia, combined or singly, produce the untoward results—for example, spastic cerebral and spinal paralysis, porencephalus with idiocy, syringomyelia, congenital athetosis, chorea, epilepsy, backwardness, stuttering, and, the author would like to add, retinal atrophy, strabismus, and mental aberration. Jacobi and Kerley also emphasize the injurious effects of asphyxia. We know that in adults concussion of the brain is often followed by weak-

When the air-passages are free, it is time for external stimulation. As the catheterization of the trachea has stimulated the respiratory center, and atory movements, in the form of gasps, usually follow this operation. If action is too slow, the buttocks may be spanked, the back rubbed vigorously, gentle traction made on the tongue (Laborde, 1892). Grasping the tongue between the thumb and index-finger, it is gently drawn out and let go back 3 times a minute.

Among the host of external irritants employed for this purpose may be mentioned bath, with or without mustard, wine, etc., the hot and cold plunge, cold bath, tickling the



FIG. 730.—PROCHOWNICK'S METHOD OF RESUSCITATION.

The child is suspended by the feet, the forehead resting lightly on the table so as to deflex the chin and set out the trachea. The body is gently shaken, and the chest compressed between the thumb and four fingers squeeze out foreign matter from the bronchi. Now an assistant wipes out the throat, and the pressure on the suddenly relaxed. Air may be heard rushing in. The compression and sudden release may be repeated 16 to a minute.

snuff, dilatation of the sphincter ani, hypodermic injections, adrenalin, electricity, etc. The bath may not be prolonged over five minutes. A better method is to wrap the infant in towels and lay it on a warm-water bag. The alternating cold and hot plunges are distinctly ing to the tender infant, and in my opinion dangerous, as well as unnecessary.

Where the respiratory center is still responsive, no more need usually be —indeed, more may be harmful. The accoucheur simply keeps the infant cool. If the child is improving, the gasps recur with increasing frequency, or tiny atory motions of the chest become visible and the heart impulse grows strong and regular. Soon the gasps become double, and end with a long inspiratory expiratory being attended by a light moan. Now, between the gasps, the



respiratory movements of the chest become more pronounced, while at the same time the cyanosis begins to lighten and give way to redness, soon after which the child gives a lusty cry. It is best to leave the infant alone as long as it improves, and in all cases precipitate and frantic haste with trials of different methods in rapid succession is to be condemned.

If improvement is not immediate, and if, from the start, the case impresses me as one of asphyxia pallida, this simple treatment does not suffice. Time may not be wasted trying the various skin reflexes, but two serious purposes must be accomplished—first, oxygen is to be gotten into the fetus' blood by artificial respiration; second, the circulation, which is almost in abeyance, must be started again. Of the numerous methods of artificial respiration, only three are really valuable—rhythmic compression of the child in inverted suspension (Fig. 730);

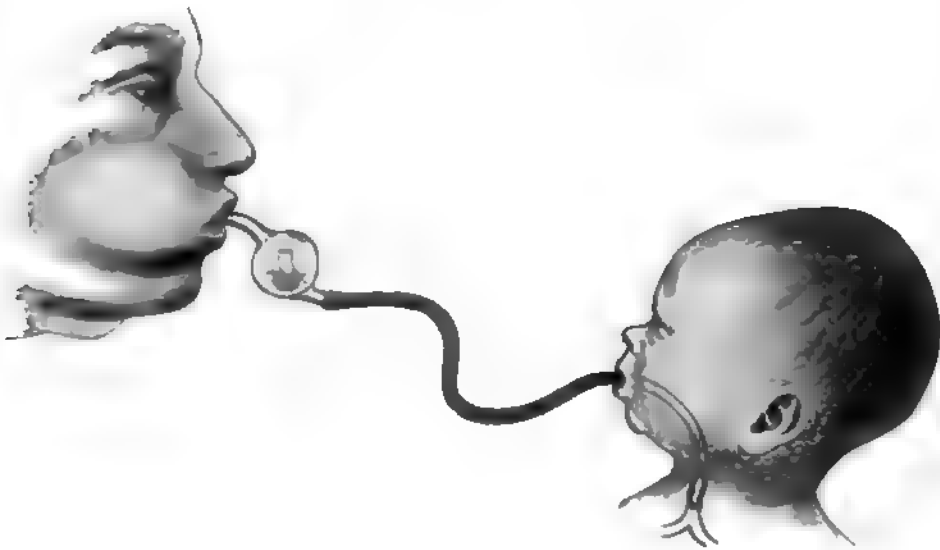


FIG. 731.—MOUTH-TO-LUNG INSUFFLATION WITH THE TRACHEAL CATHETER (Smellie).

After inserting the catheter as was done for the removal of mucus, the operator fills his lungs and mouth with fresh air, then applies his lips to the mouth-piece, with his glottis closed, and simply, under the gentle action of the cheeks (like a glass-blower), forces pure warm air into the child's lungs. Only as much as can be held in the mouth may be forced in. Compression of the chest causes the air to escape, and this procedure may be repeated fifteen times a minute. Baumert, in June, 1866, recommended oxygen for this purpose. I have used it instead of air, and in a few desperate cases it has seemed to me to be better, but there is danger of giving too much and causing asphyxia.

mouth-to-lung insufflation with the tracheal catheter (Fig. 731), and Schultze's swingings (Fig. 732).

Which of these three methods will be chosen depends on the severity of the asphyxia and the preference of the operator. Authorities are divided as to the relative value of tracheal insufflation and Schultze's swingings. The former is said to be dangerous because of the possible production of emphysema from rupture of the alveoli, and it requires considerable skill in intubation, while it does not produce the stimulating effect on the heart and blood-vessels which the swingings do. Richat proved that it is possible to blow air into the vessels of the heart and cerebral circulation if too much force is used. Performed as here described, I believe there is none of these dangers, and insufflation has most of the advantages of the swingings.

Schultze's swingings are really dangerous, though most of the accidents reported are due to errors of technic or to the injuries suffered in operative delivery. Rupture of the liver or of the spleen, hemorrhages into the peritoneum, the pleura,

## CAPUT SUCCEDANEUM.

1. Is present at birth.
2. Soft, boggy, and pits on pressure.
3. Not well circumscribed.
4. Dark red, mottled, sometimes purple and ecchymotic.
5. Lies over sutures.
6. Movable on skull and seeks dependent portions.
7. Is largest at birth and grows smaller, disappearing in a few hours.

## CEPHALHEMATOMA.

1. May not appear for a few hours or at birth.
2. Soft, elastic, no pitting.
3. Sharply circumscribed, and with a sometimes hard, edge.
4. Unless under a caput, normal skin.
5. Limited by sutures to individual
6. Fixed to site originally taken.
7. Appears after a few hours, grows in time, and disappears only after months.



FIG. 733.—DOUBLE CEPHALHEMATOMA.  
This followed a spontaneous and relatively easy delivery.

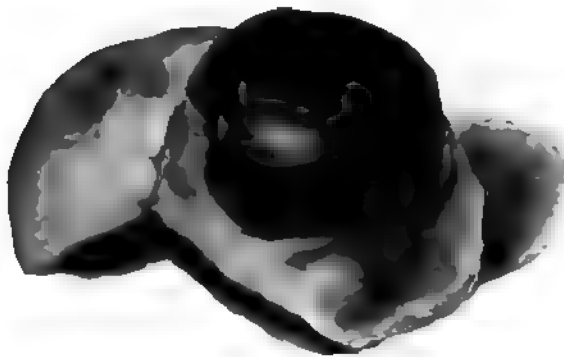


FIG. 734.—CEPHALHEMATOMA (from the collection of Dr. W. W. Jaggard).

In hernia cerebri the location of the tumor, the more or less marked pedunculation, the translucency, the impulse when the child cries, the meningeal symptoms will make the diagnosis easy.

Direct injuries to the scalp; cutting by forceps; pressure necrosis from constricted pelvis and exostoses; punctures and tears with instruments under the mistaken idea that the scalp was the membranes; tearing off of an ear, crushing of the ear (later deflected septum and ethmoid troubles); subcutaneous hematomata in the cheeks and neck from forceps; fracture and dislocation of the jaw (breech extractions); tearing off of an eyelid; complete enucleation of the eyeball; conjunctival hemorrhages, corneal opacities—all these I have seen either in my own or in consultation practice. Wolff and Paul have found retinal hemorrhages and detachment in a large percentage of normal labors, and almost always after operative delivery with more or less asphyxia. Fracture of the orbital plates; hemorrhages into the chambers of the eye and around the eye (exophthalmos), in the optic nerve; dislocation of the lens; paralysis of the eye muscles (from intracranial as well as from cranial trauma); congestion of the optic nerve vessels and secondary atrophy of the bulb—have all been reported, and should lead to care in operations (Wolff, Jaqueux). Similar hemorrhages occur in the ears and may cause deafness. It would be interesting to learn how many deaf-mutes had difficult births.

*Other Injuries.*—Fractures of the skull have already been considered. The cone-shaped and grooved depressions of the bone which need not always be comminuted with fracture or fissure are the commonest, but fracture at the base, rupture of the occipital plate from the condyles (with breech extraction); laceration of the capsular ligament between axis and atlas, and rupture of the sutures have been observed. Tearing of the tentorium cerebelli deserves special mention as a cause of hemorrhage into the brain and of fetal asphyxiation (Beneke). Meyer reports 24 cases of it in 64 children still-born or dying shortly after birth and coming to autopsy. One occurred during cesarean section.

*Hemorrhage into or on the brain* may accompany a fracture, a fissure, or come from rupture of a cerebral or meningeal vessel sometimes caused by extreme overlapping of the cranial bones in cases of marked molding of the head, the sinuses being compressed; it may be the result of asphyxia—indeed, from no apparent cause, as in one of my cases after a spontaneous labor attended with no compression of the head and no anaërosis. The clot is almost always subdural and bilateral. Philitic children are predisposed to brain hemorrhages (Osler). Bleeding may take place in the spinal canal also, and be limited here.

The symptoms come on within three or four days,—usually the second day,—and if the bleeding is a slow one, may last a week or more. They are restlessness, crying, refusal of food, inability to swallow, twitchings of groups of muscles, of one side, or general tremors, especially of the lower jaw, signs of local irritation, for example, chewing or sucking movements, irregular pupils, nystagmus, sharp, high-pitched, cramp-like cry, coma, cyanosis of the lips, often fever, even 103° F., pallor of the skin with dermographism, rapid and irregular respiration, sometimes Cheyne-Stokes', rapid pulse, 160 to 180, prominent tense fontanels, convulsions, rigidity of the body, then paralysis with cyanosis, cessation of respiration, and finally of the heart. Edema of the retina shows the increased intracranial pressure (Kearney), and the spinal manometer at lumbar puncture may measure it.

The prognosis of cerebral hemorrhage is not absolutely bad. A few of the children presenting even positive signs may recover, but usually the later history is unfavorable—epilepsy, idiocy, spastic paralyses, etc.

Mild symptoms of "meningism" are not seldom observed after operative deliveries. They are probably due to acute cerebral congestion, possibly with tiny hemorrhages, and subside in a few days. The treatment of cerebral hemorrhage in infants is symptomatic. It consists of the administration of sodium bromide and chloral, of each 2 grains per rectum every six hours; mother's milk, and quiet nursing. Human or horse serum may be administered in an attempt to arrest the bleeding. Lumbar puncture may be used for diagnosis; as a therapeutic measure it offers little hope. The same is true of puncture of the fontanels, though in

appropriate cases this should be tried. If the symptoms point to cortical pressure, that is, if they are localized, trephining should be considered. More is to be hoped from a decompression operation than we have heretofore expected (Commander, Seitz, Cushing). Henschel collected 16 cases giving 7 recoveries. (See Meyer.)

The differential diagnosis between subtentorial and pretentorial or cerebral hemorrhage can sometimes be made. Spasm, convulsions, twitchings of face and extremities, increased respiration, slow pulse and respiration, bulging of the fontanels, irregular pupils, paralysis of cerebral nerves, exophthalmos, conjunctival hemorrhages—these symptoms point to hemorrhage over the hemispheres. The child cries much in a loud high-pitched tone. Spinal puncture is negative, but aspiration of the subdural space will often help in the diagnosis. The needle is inserted at the outer angle of the large fontanel, being directed backward under the parietal bone. Both sides are punctured, and if necessary the posterior fontanel also.

In subtentorial or peribulbar hemorrhage the breathing is irregular, convulsions less marked, the cyanosis greater, the child is quieter, the symptoms come on earlier and follow more immediately the asphyxia after delivery. Spinal puncture gives bloody fluid. If the blood is too firmly clotted all punctures may be negative.

*Facial paralysis* frequently results from injury to the nerve as it leaves the stylomastoid foramen. Forceps are usually to blame, but compression from a contracted pelvis or abnormal attitude of the child, for example, sharp flexion of the neck on the shoulder, may cause it (Dahlman). It may be due to primary agenesis of the ear vesicle (Carlsson). Central lesions of the nerve are due to cerebral trauma and hemorrhage. Here the paralysis comes on after the first day, and in the peripheral forms it appears right after delivery. Usually in a few hours to a few days the facial deformity is gone, but it may last three months or longer. In central types, and if there is a fracture of the temporal bone, it may be permanent. The paralysis may be only part of a congenital facial hemiatrophy. The differential diagnosis between the two types is made on the usual lines; peripheral paralysis, when there is extensive involvement of the distribution of the nerve, lagophthalmos, absent reflexes, etc., and central, when the eye is not involved, the reflexes present, and there are other cerebral symptoms, etc. No treatment is required. In the chronic cases muscular atrophy should be prevented by massage and electricity.

**The Trunk.**—Fractures of the spine, disruption of the vertebræ, separation of the condyles from the occipital plate, dislocation of the atlas on the axis, occur in violent breech deliveries and cause instant or rapid death. In nearly all cases they are errors of art. Palpation of the spine from the outside or through the pharynx will enable the diagnosis to be made. Complete avulsion of the trunk from the head is rare: the head may be torn off the body, or the body from the head, leaving the latter in the uterus, two cases of which have come to my knowledge. Unless the tissues are pathologically soft, macerated, or actually brittle, such an occurrence is the result of *delirium operatorium*, an acute lapse of operative reason which may affect the accoucheur after much loss of sleep, the nervous wear of a prolonged labor, the exactions of the family, combined with the sudden appearance of extraordinary difficulties. The head in these cases is usually easily removed, but it has been left, to come away finally by prolonged suppuration, with fistulas, lasting months or years, or the woman may die of sepsis.

*Rupture of the sternocleidomastoid muscle* is not so rare an accident as statistics would show it to be. It is often overlooked or intentionally secreted for fear of the legal responsibility, which older authors erroneously attached to it. Rupture of a healthy sternocleidomastoid can be brought about only by very violent traction, combined with extreme torsion of the head. I have often demonstrated the possibility of turning the head of a new-born infant through an arc of 200 degrees or more without even making it cry. The blade of the forceps may directly crush the muscle, and this injury, in the absence of antecedent disease, in my opinion is more likely to cause permanent caput obliquum, than that of overstretching in breech deliveries, though most of the reported injuries (not developed wry-neck) occurred with breech presentation. Injury to other cervical muscles may increase the deformation and consequent distortion.

Two conditions are found—a hematoma in the muscle, usually in the upper third, and a fusiform enlargement, attended with great tenderness and often febrile reaction. Without doubt—and in this the author is sustained by Pincus and Petersen—the muscle was already shortened and pathologically altered while the child was still in utero, and the labor was only the acting cause. Caput obstipum may follow normal and easy labors, with and without injury to the muscle determinable at birth, all of which is important from a medicolegal point of view. Indeed, the frequent concomitant facial hemiatrophy points to a central origin of the disease. Shortening or rigidity of the muscles will be found not infrequently in new-born children which have lain in the uterus in a cramped attitude for longer periods, and especially if the liquor amnii is scanty. Indeed, the head of the child may be flattened or twisted. For example, in breech cases, in primiparæ, the posterior sternomastoid is shortened and the anterior parietal bone flattened; in multiparæ, owing to the pendulous belly, the posterior parietal is flattened and the anterior sternomastoid shortened. Sometimes the arms or the legs of the child are fixed by the shortened muscles in bizarre attitudes, and it requires some force to straighten them. The bones may be bent and broken by the forces of labor.

If the healthy muscle is crushed or torn, whether or not a hematoma forms, spontaneous recovery is the rule, and *shortening is absent*, a fact which experience in general surgery will confirm. If the injured muscle becomes infected, by way of the blood, from the bowel, the navel, or the lungs (Mikulicz), a myositis may occur and shortening will follow. Hematomata are usually observed shortly after birth as a hard knot in the muscle, which is only slightly tender. Myositis is found later—fourth to twenty-first day—as a hard, fusiform swelling of the whole muscle, exceedingly tender, together with febrile symptoms. Myositis causes the child to cry much, especially when handled; indeed, these symptoms may attract attention to the trouble. The early diagnosis is easy,—one finds the head turned to the affected side, the tenderness, and the tumor. In paralysis of the nervus accessorius the head is turned to the well side. This latter is similar in cause to facial paralysis, and usually heals quickly. In later life dislocation of the vertebræ and facial hemiatrophy come up for consideration.

Treatment of injury to the sternomastoid and of the other cervical muscles consists of prevention, in the first place, and rest of the muscle after it occurs. During breech deliveries the possibility of injury must be borne in mind, but during forceps operations it is usually impossible directly to protect the muscles, except by a strict observance of the indications and proper technic. After delivery the child is to be handled as little and as carefully as possible, the nurse being properly instructed. In several cases I had the infant strapped to a well-padded board like a papoose for a week, and bathing omitted (Couvelaire, Behm, Fitzsimmons).

*Injuries to every one of the viscera* of the chest and abdomen have been reported, rupture with hemorrhage being the usual finding. Fractures of the ribs and sternum in version and breech extraction have occurred. In one case I found that the attending accoucheur had dilated and ruptured the anus, thinking it was the tightly closed cervix, and in another the child's perineum and rectovaginal septum had been torn through under the same erroneous impression. The swollen scrotum has been held for the membranes and punctured. Spontaneous rupture of the umbilical cord occurred in two cases in the service of the Chicago Lying-in Hospital Dispensary, in one of which the child died. The cord in one case was very brittle. During a forceps operation I inadvertently cut the cord clean across with the very tip of the blade. Tearing of the cord off the placenta, off the belly, once with stripping up of the abdominal wall, rupture of the veins, rupture of a large varicosity, have all been observed, either with or without the action of external trauma (important medicolegally). A too brittle cord, coiling, or a knot is usually responsible for the spontaneous injuries.

Paralysis of the muscles of the extremities is not an infrequent result of severe operative deliveries. Central cerebral or spinal-cord lesions result usually in extensive paralysis, often with rigidity and athetosis, for example, cerebral spastic paralysis (Little), diplegia, hemiplegia, paraplegia. Of the local paralysis, Duchenne-Erb's is clinically the most important, though isolated paralyzes and pareses occur—for example, one whole arm, the forearm and elbow, from brachial nerve injury or callus. Erb's paralysis is due to injury of the fifth and sixth motor roots of the brachial plexus, such injury being due to direct pressure on these nerves as they issue from between the scaleni muscles, or to compression between the clavicle and the first rib, to tearing of the nerves by direct trauma, as from a broken clavicle, or overstretching from excessive pulling on the neck, or from tearing of the roots of the nerves out of the spinal cord. The paralysis is usually a traction lesion and may

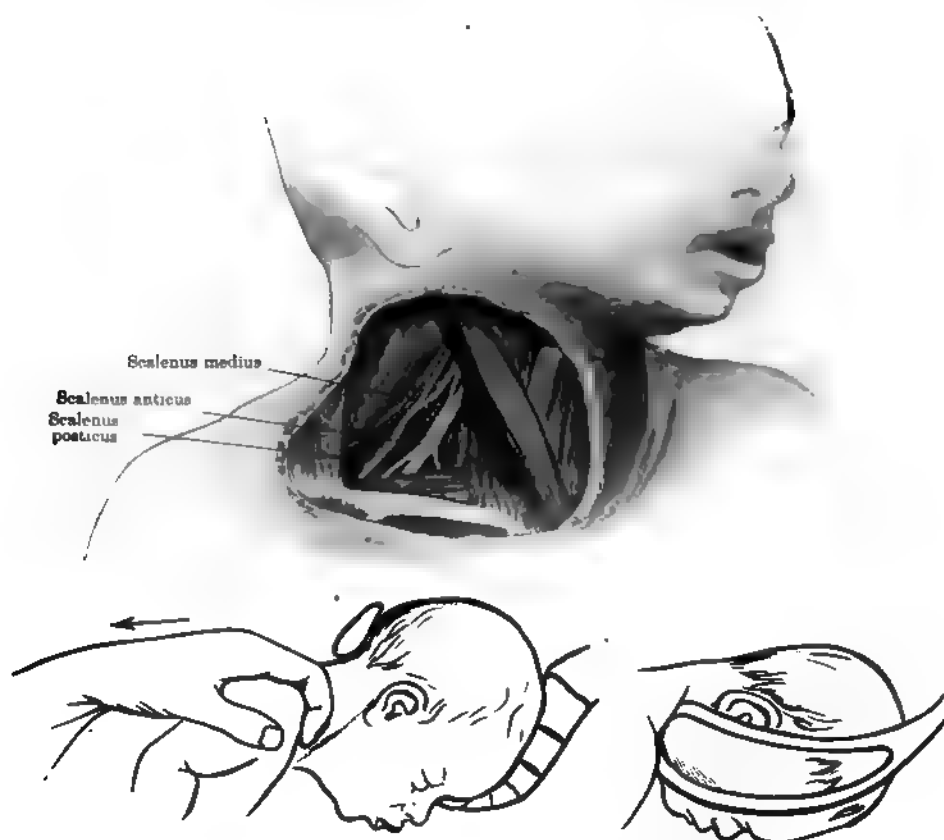


FIG. 735.—SEMI-DIAGRAMMATIC, TO SHOW THE PART OF CERVICAL PLEXUS INJURED BY FORCED DELIVERY. This is the so-called Erb's point. Sketches below show usual mechanisms of injury. In one the nerve-roots may be torn out of the spinal cord, in the other the plexus is crushed by the instrument.

be unilateral or bilateral. Compression by the blade of the forceps and by callus formation is also to be mentioned, and in these cases the paralysis is a little more likely to disappear. The muscles involved are the deltoid, the supraspinatus and infraspinatus, the coracobrachialis, brachialis internus, the biceps, and in some cases the supinators longus and brevis. A characteristic position is assumed by the arm. It hangs flaccid at the side of the chest, with the hand rotated inward, thumb pointing back. Flexion of the forearm on the arm and supination are unable. Sensibility remains intact, but muscular atrophy is rapid. The prognosis is fair. Cases in which the signs are mild, and perhaps due to bruising, with

update around the nerve-roots, may recover, but if the paralysis shows no improvement in a month, or if neuritis exists, the outlook is gloomy.

The greatest field lies in prevention. In ordinary labor, during the delivery of the shoulders, care must be taken not to lift the head up nor to pull it down from behind the pubis too sharply, and in breech cases the neck may not be stretched too much, nor the fingers allowed to draw directly upon the cervical muscles and nerves. When the clavicles are fractured, Schultze's swingings may not be practised. In the case I was convinced that the end of the bone ground into the cervical plexus during this operation. An x-ray picture should be taken to determine if a broken bone is the cause, or a subluxation of the head of the humerus, or a fracture of the neck. If the röntgenogram shows the shaft of the humerus broken from the epiphysis, an osteoplastic operation should be performed. In the differential diagnosis central lesions, syphilis, etc., are to be considered. Treatment is on general neurologic lines. Lately, nerve transplantation operations are being done on such cases (Taylor, Sharpe).

*Fracture of the bones of the extremities*, especially of the clavicle, is quite common. A physical examination of new-born children, as ether has done, will show that this occurs much oftener than is expected. It may be a hard lump on the bone (the callus) which draws attention. Clavicle fractures occur from direct trauma, as by pulling on the bone in breech presentation, or indirectly by pulling on the arm or the head, the bone being caught between the source of the power and the pelvis. Bringing down the arms in either head or breech presentations, pulling up or down on the head to deliver the trunk, pulling through the finger in the axilla, and even the power of natural labor when the shoulder arms against the pelvis, may break the bone. I observed one fracture of the clavicle in a spontaneous labor with very strong expulsive pains and heard the bone crack. If, after every operative delivery, the child be carefully inspected for injuries, such a fracture will not escape notice, mobility, crepitus, and deformity being present. Greenstick fracture may occur. The favorite site is the outer third, but the middle may break under direct pressure, and the bone may snap at, or be torn from, its attachment to the sternum or scapula. The treatment is simple. A small pad of absorbent cotton is placed in the axilla, the arm bandaged to the side, and the bandage well sewed in place.

Fracture of the humerus results from direct trauma in delivering the arms. I have twice deliberately broken this bone to save the child and succeeded. Separation of the diaphysis from the epiphysis is much more common and more serious because it may easily be overlooked. The epiphysis is rolled out, the arm rolled in (as in Erb's paralysis), and if healing is thus allowed, permanent disability and maiming result. To prevent such injuries the proper technic should be practised in arm and shoulder delivery. Dislocation of the humerus is very rare—usually fracture is mistaken for it.



FIG. 736.—CASE OF ERB'S PARALYSIS.

Fracture of the femur is almost always an error of art, too much force, or force applied in a wrong direction, being the cause. Bringing down the leg with bad technique, grasping it improperly, and pulling out of the axis of the pelvis are usually responsible. Nowadays few accoucheurs put the forceps on the breech or use the blunt hook or slings. Even the finger in the groin may break the bone. Dislocation of the femur is rarer than fracture, but separation of the epiphysis is commoner. It may be impossible to distinguish between congenital and acquired dislocation of the femur—indeed, a traumatic dislocation can hardly occur, fracture of the epiphysis usually being the result of force exerted on the joint. Crede's method is the best for the treatment of fractured femur. The thigh is bound against the abdomen of the child—using its body as a splint. To prevent outward bowing a piece of cardboard may be laid on the outside of the thigh.

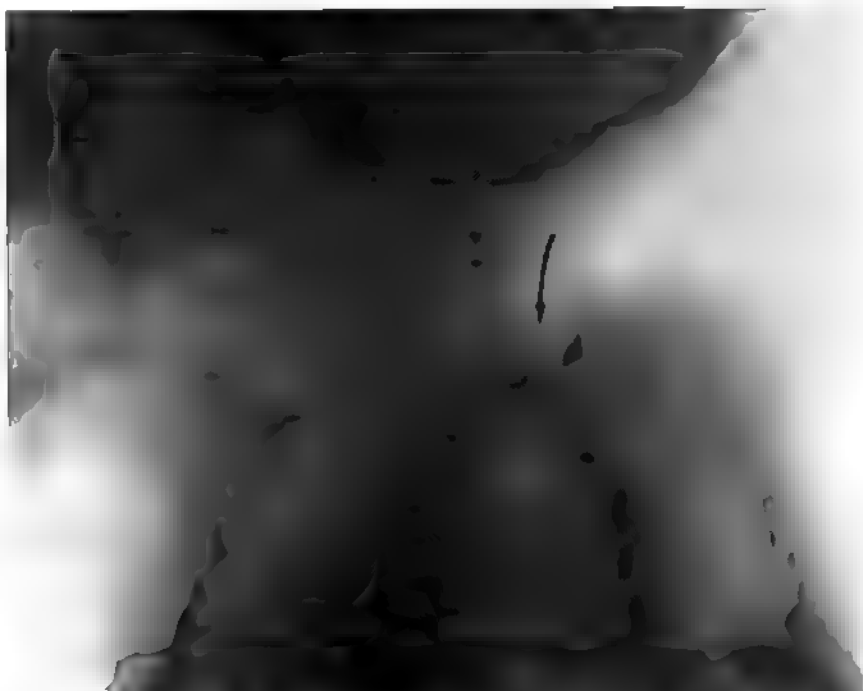


FIG. 737. FRACTURE OF LEFT CLAVICLE.

Breech extraction through generally contracted pelvis (slightly retouched by author).

Spontaneous fracture of any of the long bones may occur in labor. In one of my cases two children of one mother had broken clavicles because of fragility of the bones. Besides fractures, the extremities may be torn or bruised or infected by the attendant, or they may suffer pressure and gangrene by being imprisoned between the head and the pelvis. If the x-ray is to be used to aid the diagnosis of fractures, etc., the exposure must be very short, since young infants are susceptible (O'Donnell).

A very important consideration is the medicolegal aspect of all these injuries, since too often the physician has to defend himself against damage suits because of them. While it is true that most of these traumatisms can be prevented by proper application of our art, it is equally true that, with few manifest exceptions, they can be brought about by the forces of natural labor alone. Since this is a fact, in any given medicolegal case it will be necessary to prove that the particular injury was plainly due to carelessness, ignorance, or lack of skill on the part of the accoucheur. In passing judgment, also, these things must be borne in mind. Our medical



tools do not as yet furnish enough material so that the general practitioner can get the proper training to meet all the emergencies that may arise; the surroundings of the labor case in a home; a low bed and none or inefficient assistance; the loss of sleep; the nervous wear and tear of a confinement case, and the state of mental fatigue in which the accoucheur often has to undertake the most dangerous and delicate operations, involving two lives; and, finally, many of the accidents named, have occurred in the hands of the best obstetricians the world has known.

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## SECTION VII

# PATHOLOGY OF THE PUERPERIUM

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NOWADAYS the puerperium, aside from after-pains and minor disturbances of urination and of lactation, is usually an uneventful convalescence. When the soreness is gone from the muscles and joints and the body functions are ordered, which requires about seventy-two hours, the puerpera should feel as well as, if not better than, she ever did. Two dangers, however, beset her: infection of the genitalia and infection of the breasts. Naturally, a woman at this time may be seized with any general or local disease, as typhoid, pneumonia, the exanthemata, erysipelas, etc., and such affections are usually aggravated by the puerperal state. In importance, however, puerperal infection overshadows everything else.

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## CHAPTER LXIII

### PUERPERAL INFECTION

PUERPERAL fever is a term introduced by Richard Morton in 1692 to apply to an acute febrile disease which seized lying-in women and exhibited a high degree of fatality. Willis (about 1662) wrote of "febris puerperarum."

**History.**—In the primitive practices of savages untouched by civilization are found many evidences that puerperal fever existed among them, and that means of prevention were adopted—for example, the isolation of the parturient and puerperal members of the tribe, the cleansing bath in a stream after labor, the fumigations of the vulva with aromatic herbs, fumigation of the apartment after the puerpera left it, washing the belly with banana wine, etc. In the Ayur Veda of Susruta, a thousand years before Christ, it is mentioned. Hippocrates (400 B. C.) describes cases of it so accurately that the words could well be read in a modern class-room. He mentions epidemics of the fever. Celsus and Galen describe it, and historic references to it throughout the middle ages are numerous. The first authentic report of an epidemic of the disease is given by Hervieux, and is said to have occurred in Leipzig in 1652 to 1665. The first lying-in ward was established in Paris at the Hôtel-Dieu, and here the great obstetricians, Mauriceau, de la Motte, Portal, and Peau, obtained their experience. Mauriceau states that, in 1660, an epidemic of puerperal fever broke out in the city of Paris and in the Hôtel-Dieu, and here two-thirds of the women delivered died of it! Even in 1831 the mortality still was 9 per cent. in the Paris Maternity. In 1750 and 1761 epidemics occurred in London; in 1772, in Edinburgh; in Berlin in 1778—to mention only a very few of those reported. Since the maternities were opened to students at the same time the states placed dead bodies at the disposal of the universities for study and instruction, it is easy—for us—to see why the scourge increased. In Vienna, where the postmortems of the great Rokitansky were so assiduously visited by the students, the disease raged fearfully. In 1842 the mortality of the women varied, with the months, from 18 to 31 per cent. Every day there were two or three autopsies on such cases, and the students went directly from the morgue to the lying-in room. In England the disease was very well known, and it was there considered contagious, like smallpox. (For History, see Fasbender, Mauriceau, Semmelweis, Holmes, Sinclair.)

**Definition.**—Puerperal fever, or puerperal infection, is a general term embracing all the conditions, usually of a febrile nature, but sometimes non-febrile, affecting puerpera, originating from infection of the genital tract at any point of its extent.

It matters not whether the symptoms be mild, lasting but a few hours or many days, whether there be a vulvitis, an endometritis, or a septicemia, whether one

of the milder forms of saprophytic bacteria or the most virulent streptococcus be causative, whether the patient has fever or rapid pulse—if the complexus of symptoms points to a genital infection, the woman suffers from puerperal fever. This definition shuts out small-pox, malaria, the essential infectious fevers, for example, typhoid, diphtheria of the throat, erysipelas of all other portions of the body but the genitals, etc., and since it includes many and widely differing clinical forms of disease, makes a careful classification of these forms necessary. This is not easy. The exact nature of puerperal infection has been discovered through the science of bacteriology.

Up to the seventeenth century the theory of Hippocrates was the generally accepted one. He ascribed the disease to suppression of the lochia, taking the effect for the cause. Celsus and Galen, Avicenna, Mauriceau, Sydenham, and Michaëlis accepted this theory. If, as the probable result of fright, of taking cold, etc., the lochia ceased, they were absorbed into the blood and caused puerperal fever. Mercurialis, and especially Puzos, of Paris, taught the *milk theory*. During pregnancy the milk secretion begins, but it is all determined to the uterus, where the fetus uses it for nourishment. After labor it is excreted by the breasts. If by catching a cold, etc., the secretion should be checked, so-called milk metastases occur and cause fever—again mixing cause and effect. Then the milk appears in the lochia (the purulent lochia of sepsis), in the peritoneal cavity (the pus of puerperal peritonitis), in the pleural cavities (pus from pleuritis), or in the joints (pyemic arthritis). Chemists even claimed to have made butter from the exudate in the peritoneal cavity, one saying he had found sour milk and butter under the skin of a woman dead of puerperal fever.

There was no lack of other notions. Plater, in 1602, said it was a metritis; Hunter, in 1780, peritonitis; Tonnelé, in 1830, a lymphangitis, etc. Mauriceau called it malignant fever, others a gastric or bilious fever, puerperal erysipelas, typhus, omentitis, putrid fever, etc.

Cruveilhier said it was somewhat like typhoid, while the "essentialistes," as they were called in France, among whom are the names of Dubois, Depaul, Litzman, and Michaëlis, said it was due to a miasm and was a specific contagious process, propagable through the air, and governed by telluric, cosmic, and atmospheric influences, etc., a view later held by Fordyce Barker in America.

Ideas of the infectious nature of the disease had long been held. Levret (Paris, 1770), in speaking of Smellie's leather-covered forceps, asks if contagion could not be carried in the blood which decomposes in the meshes of the leather. In England, Charles White, in 1772, said that other persons could be infected by the discharges of a septic puerpera; in 1795 Gordon referred to the contagiousness of the disease, and Denman, in 1768, declared it was carried by physicians and midwives from one puerpera to another. One quotation, whose origin I cannot find, states that the disease may be carried on sponges used on several puerpera. Dr. Blackman, in Edinburgh, in 1845, said that puerperal fever was conveyed by the dirt under the finger-nails. Abstinence from obstetric practice was enforced on physicians who had a succession of puerperal fever cases, and even the use of chlorid of lime for the hands as a disinfectant was recommended.

In 1842 our own Oliver Wendell Holmes heard a report of the case of a physician who, inoculated at a postmortem, died of septicemia, but before this had attended several women in labor who also died of the same disease. Struck with this association of fatalities, he studied published articles on the subject, and in 1843 presented his results in a paper entitled "The Contagiousness of Puerperal Fever." He proved, by an array of clinical reports, that it was carried from one patient to another as a *contagium*, and that, also, it was caused by *inoculation* of the puerpera, and that the sources of infection could be erysipelatous processes as well as cadaveric poisons. He suggested these rules of prophylaxis:

- "1. A physician holding himself in readiness to attend cases of midwifery should never take any active part in the postmortem examination of puerperal fever cases.
- "2. A physician present at such postmortems should use thorough ablution, change every article of dress, and allow twenty-four hours or more to elapse before attending a case of midwifery.
- "3. Similar precautions should be taken after the autopsy or surgical treatment of cases of erysipelas if the doctor is obliged to unite such duties with his obstetrical work, which is in the highest degree inexpedient."

Holmes' views met violent and bitter opposition from the two foremost obstetricians of the time, Hodge and Meigs, and made very little impress on the profession. In 1855 he again took up the subject, but, unfortunately, for the last time.

In 1847 Semmelweis, a young assistant in the clinic in Vienna, which was later occupied by Carl Braun, announced that puerperal fever is caused by the absorption into the blood, from the genitals, of *decomposed animal matter* from any source; that the hands, or any article brought into the genitals, may be the carriers of same. He did not come upon this by accident, but it was the result of years of hard work and study. He noticed that the division of the clinic which was used for the instruction of midwives had a 2.7 per cent. mortality from puerperal fever, while that for doctors had 11.4 per cent., and that the children were affected with sepsis proportionately also. The discrepancy between the two clinics was public knowledge—it was the subject of municipal

investigation; the midwives taunted the physicians with the facts, and the patients who learned they were to be assigned to the doctors' clinic, on their knees would beg to be sent home. Semmelweis noted that the disease prevailed with irregular, unassignable fluctuation.



*Semmelweis*

FIG. 100.—IGNAZ PHILIPP SEMMELWEIS.  
Below is the monument marking his grave in Buda-Pest, Hungary.

and were sent to the hospital but not in the homes, that women who were delivered on the street or in the hospital seldom suffered, that parturients who had long, hard or instrumental labors were nearly always affected, that one or the other assistant had the most cases, that instrument

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<i>Streptococcus pyogenes.</i>	<i>Bacillus pyocyaneus.</i>
<i>Streptococcus viridans.</i>	<i>Bacillus proteus.</i>
<i>Diplostreptococcus puerperalis.</i>	<i>Bacillus aërogenes capsulatus.</i>
<i>Streptococcus anaërobis putridus.</i>	<i>Bacillus fusiformis and spirilla (hospital gangrene).</i>
<i>Diplococcus lanceolatus pneumoniae.</i>	<i>Bacillus typhosus.</i>
<i>Staphylococcus aureus and albus.</i>	<i>Bacillus tetani.</i>
<i>Anaërobic staphylococcus (Hüsey).</i>	<i>Bacillus anthracis.</i>
<i>Bacillus coli commune.</i>	<i>Bacillus diphtheriae.</i>
<i>Gonococcus of Neisser.</i>	<i>Bacillus influenzae.</i>
<i>Bacillus pneumoniae of Friedländer.</i>	

A host of bacteria of putrefaction and decomposition exist, a few of which may be mentioned: *Micrococcus fœtidus*, *Bacillus funduliformis*, *Bacillus racemosus*, *Bacillus radiiformis*, *Bacillus pseudotetani*, *Bacillus nebulosus*, *Bacillus caducus*, *Staphylococcus parvulus*, anaërobic streptococci, and many more named and unnamed. It is impossible, with our present cultural methods, to grow many of the bacteria which appear in smear preparations.

It is rare to find one of this number the sole cause of the disease. Usually two or more, even to the number of 15, have been found. The streptococcus combines with the staphylococcus, or the *Bacterium coli* or *pyocyaneus*, the latter increasing the virulence of the former. Symbiosis usually seems to aggravate virulence. The proteus and the *Bacterium coli*, or the proteus with the staphylococcus group, may cause bad infections, as do the combinations of coli and *Bacillus aërogenes capsulatus*.

Neither the symptoms nor the bacteriologic examination nor the autopsy findings will invariably permit us to decide which organism was the causative one. A probable diagnosis may often be made.

**Sources of the Infection.**—These bacteria are to be found in decomposing animal and vegetable matter, cadavers, in diseased animals and human beings, their excreta, in the air, and in dust. The most important ultimate source, so far as our subject is concerned, is the diseased human being. The poisons are carried from suppurations, gangrene, ulceration, infections which are excreted, as diphtheria, scarlet fever, pneumonia, nasal catarrhs, etc., erysipelas, necrotic cancers, lochia (even of normal puerperæ), the menstrual blood, and, very commonly, from postmortems.

**Modes of Transmission to the Genital Tract.**—Simmelweis distinguished two modes of inoculation—one, from without, *exogenous* infection; and one from within, *endogenous* infection.

**Autoinfection.**—As our knowledge of the subject grew and our preventive measures became more and more successful, there appeared those who declared that all cases of puerperal infection were exogenous in origin (for example, Jaggard), and that, therefore, when a woman took sick with a puerperal process, some one was to blame for it. The results of this teaching are still wide-spread and still cause a great deal of injustice, because it is not true. Ahlfeld, since 1885, and a few others—Winckel, Koch, Tarnier, Doléris—had always maintained that, in addition to the inoculation from without (hetero-infection), the woman occasionally became infected from bacteria which she carried in her own person—autoinfection. Leopold, Döderlein, Krönig, Fochier, Pestalozza, and Williams denied the possibility. Some of these authors have changed their minds. Ahlfeld distinguished three kinds of autoinfection—first, that from bacteria in the genital tract, including the vulva (*e. g.*, gonorrhœa), whether they entered the tissues themselves or were introduced by absolutely sterile fingers or instruments; second, that transported to the genital canal via the blood from a distant site of suppuration, such as the tonsils, lungs, a mastitis; and, third, the infection of the genital canal from contiguous abscess, for example, appendicular abscesses, pyosalpinx, pyelo-ureteritis. To this it be added a fourth, the inoculation of the patient by herself with bacteria present on her hands, or carried by her from a focus of suppuration, for example, ulcer cruris, tonsillitis, a sinus disease, otitis, abscess of the breast, and

tertrigo, etc. It is hard to differentiate this form from Ahlfeld's second form. With Wegelius, Winter, and Walthard I would prefer to limit the term auto-infection to those cases where the bacteria of the genital tract, including the vulva, develop virulence and invade the tissues, or produce poisons which are absorbed, without any possible external agency. It is better to exclude from this definition reference to the transference of infection from other foci in the body, as well as the admission that even the aseptic hand may introduce the bacteria which were present in the vagina into the puerperal wounds. (See Benthin.)

On the ground of clinical experience I am forced to admit the frequent occurrence of autoinfection, in the broad sense that Ahlfeld holds, and in the narrow definition first proposed it also occurs, but the cases are very few in number. The question has held the attention of the best obstetricians and bacteriologists of our time, and innumerable and laborious investigations have been made, but the results were so conflicting that its solution, until within a few years, seemed impossible. Whether a woman may or may not be infected from within during labor depends on whether or not the vagina may, under the usual conditions of life, the woman being in apparently healthy, harbor pathogenic bacteria. Mention of only a few who took part in the polemic need be made—Döderlein, Kaltenbach, Ahlfeld, Krönig, Menge, Bensus, Steffek, Vahle, Walthard, Winter, Stroganoff, and, prominently in America, Williams, of Johns Hopkins. Krönig, Menge, and Williams believed that the vagina of apparently healthy women contained no pyogenic bacteria. Walthard, Kaltenbach, Ahlfeld, Bumm, Sigwart, and others believed that it, in a large percentage of cases, contained many, even the streptococcus. Some believe that, given favorable conditions, these bacteria could become very virulent.

The studies by Bumm, Natvig, Wegelius, Krönig and Pankow (1909), Seligman, and Permar (1917), employing very favorable culture-media (grape-sugar bouillon and blood-agar), seem to prove that the vaginas of apparently healthy women in the last weeks of pregnancy contain streptococci and staphylococci in from 15 to 75 per cent. of the cases examined, and that these bacteria, while usually living a saprophytic existence, may wander from the vulva, the vestibule, the vagina, up into the uterus or into the wounds during the puerperium and cause puerperal fever. From general practice we have analogies of auto-infection to draw upon, to mention only two examples, the acute pelvic peritonitis of virgins, the result of "catching cold" or refrigeration during the menses, and osteomyelitis in children after severe exposure. It must also be remembered that cats, pigs, and other domestic animals have puerperal fever.

On the vulva, as was to be expected, streptococci, staphylococci, *Bacterium coli*, *Bacillus pseudodiphtheriae*, and many saprophytes are to be found, and especially if there are pustular or eczematous eruptions near by, and in slovenly women. In the urethra the same germs vegetate. In cystitic urine the same and the *Proteus vulgaris*, with others still. Ascending ureteropyelitis has already been discussed, and germs here present may be dangerous to the parturient canal. Even in apparently normal women bacteriuria occurs, and the streptococcus (author), the colon bacillus, and typhoid bacilli have been demonstrated.

In the vagina, under apparently normal conditions, the following bacteria have been demonstrated (Walthard, Bar, Permar, and Wegelius):

(1) Facultative anaërobic streptococci of the type of the *Streptococcus pyogenes puerperalis*. (2) Facultative anaërobic streptococci of the type of the *Diplostreptococcus puerperalis*. (3) Obligate anaërobic streptococci of the type of the *Streptococcus anaërobicus*. (4) Staphylococci of the type of the *Staphylococcus pyogenes liquefaciens*, *albus*, *aureus*, and *citreus*. (5) *Bacterium coli*. (6) *Gonococcus*. (7) *Bacillus funduliformis*. (8) *Pseudotetanus bacillus*. (9) *Bacillus aerogenes capsulatus* (Welchii). (10) *Bacillus vaginalis* (Döderlein). (11) *Bacterium pseudodiphtheriae*. (12) Gram-positive cocci, diplococci, bacilli, and diplo-

bacilli. (13) *Micrococcus tetragenus*. (14) *Saccharomyces*. (15) *Bacillus* of Weeks. (16) *Bacillus bifidus communis*. (17) Numerous other anaërobic and aerobic philic cocci and bacilli and streptobacilli.

Döderlein distinguishes two forms of vaginal secretion—*normal*, which is white, like curdled milk, acid, contains no mucus, and is small in amount; and *pathologic*, which is thick, yellowish or greenish mucus, sometimes foamy, usually alkaline, but not necessarily so, and contains numerous pathogenic and non-pathogenic microorganisms, and the *Trichomonas vaginalis* (Hoehne), whereas the normal vaginal secretion contains only the *Bacillus vaginæ*, a harmless organism. It is certain that the pathologic discharges contain more of the mentioned organisms than do the normal, but it is not easy to divide the cases sharply into two classes either clinically or bacteriologically.

The closed cervix is infected in its lower third, the mucous plug here being cloudy yellow, showing the presence of pus and bacteria. It is white in the neck zone and clear in the upper part, being here sterile. Under normal conditions, according to the recent researches of Winter, Menge, and Walthard, the uterine cavity is sterile, but it may harbor bacteria, and they then live in the decidua and fetal membranes.

Since the bacteria mentioned exist in the genital tract of the gravida, and are there even during labor, why does not every woman become infected? First, they live as saprophytes, requiring special conditions to develop invasive qualities or virulence. We have several analogies. In the mouth and nose the streptococcus, the pneumococcus, the diphtheria bacillus, and the staphylococcus may live harmlessly, and only under extraneous influence cause sickness, but they may be infectious for others. In the intestinal canal the *Bacillus coli* and other bacteria exist under the same conditions. In the horse the tetanus bacillus, very fatal if inoculated into a wound, lives as a harmless parasite. Second, the vagina has some power of purification, at least it has qualities which ordinarily keep the activities of its flora within safe bounds—in a way similar to that of the mouth. Döderlein ascribed this power to the lactic acid produced by the *Bacillus vaginæ*, which makes the vaginal secretion unsuitable for the growth of other bacteria. Menge believed that phagocytosis going on in the cervix and vagina had something to do with it. Perhaps other immunizing forces are at work to produce local cell immunity, and the process will be explained when the biochemical studies in immunity of Metchnikoff, v. Behring, Ehrlich, and others are carried to completion. Third, during labor there are the mechanical scouring-out of the bacteria, the flow of the liquor amnii, and the outpouring of mucus and blood, and the passage of the child and placenta, which remove large numbers of bacteria. Fourth, newly let blood has antiseptic properties for a short time. The lochia (*vide infra*) in the first forty-eight hours show very few bacteria, while on the third day the increase is marked, but by this time the wounds have closed, a bank of granulations has been thrown up, through which the bacteria may not easily break, excepting the virulent streptococcus and the gonococcus, and the cervix has closed, shutting off the uterine cavity more or less. Fifth, the downward and outward current of the lochia and the mucus covering the surface must also be considered. It is important for the accoucheur to bear these things in mind, so that he does not interfere with nature's methods of protecting the puerperal woman, and, as we know, these methods are very successful.

Natvig and Wegelius have shown that the flora of the vagina in the puerperium is the same as, or at least very similar to, that of the vulva, vestibule, and vagina before labor, and many of the bacteria mentioned on p. 844 have been demonstrated in the lochia of fever-free puerperæ. Therefore the bacteria have the power to wander into and up the genital tract. In three-fourths of the cases examined the bacteria were found in the uterus itself on the fourth day. They were few in number, and almost always all obligate anaërobes, the facultatives being lightly represented. On the ninth day 90 per cent. of the cases showed bacteria in considerable number.

but they were almost entirely obligate anaërobes, only once in ten cases a facultative anaërobic streptococcus being met. In spite of all this, if the woman is not molested by meddling accoucheurs, she will almost always recover from her labor by grace of the immunities provided by nature, and while mild cases of autoinfection may occur occasionally, fatal cases are exceedingly rare. The practical lesson to be learned from these investigations is that the accoucheur should studiously and consistently avoid those conditions which render these bacteria virulent and invasive, and which carry them to regions of the parturient canal where they may unfold their latent powers. Conditions favoring autoinfection are excessive bruising of the parts from prolonged labor, great delay in delivery after rupture of the membranes, the retention of pieces of placenta in the uterus, or membranes which hang down into the vagina and form a bridge on which the bacteria may mount into the uterus, or blood-clots in the vagina, lochiometra, and lochiocolpos.

*Hetero-infection.*—Infection from without—exogenous infection—is by far the most common, and is always first to be thought of when a puerpera develops fever. Infection may be brought to the genital tract from the outside in many ways:

(1) The most common carrier is the physician or midwife, rarely the nurse. The finger, or an instrument insufficiently sterilized, introduced into the genitalia, deposits virulent germs in the tissues. These germs have been brought from a case of puerperal sepsis, from the dressing of an ulcer, or any suppurating or infected wound, from a postmortem, an erysipelas case, a cancer, pneumonia, typhoid, scarlet fever, diphtheria, from a baby with infected umbilicus or enteritis, etc., from the lochia of even normal puerperæ, or even the ordinary filth under the finger-nails. The bacteria attain great virulence by "passage" through a human being. The attendant may have the focus of infection on his own person—a felon on the finger, furunculosis, a wet eczema (they often contain streptococci), tuberculosis, ozena (as the famous case of Dr. Rutter, of Philadelphia, in the forties), an acute rhinitis, or a pharyngitis. A small epidemic in the dispensary service of the Chicago Lying-in Hospital originated from the throat of an intern. In the discharges from the nose a hemolytic aërobic streptococcus was found in almost pure culture. Some years ago a local hospital suffered an epidemic of fatal post-operative peritonitis, and a virulent streptococcus was isolated from the throats of many of the nurses and interns, as well as from the dust in the wards and operating-rooms. Schatz and Benthin observed puerperal fever epidemics of similar origin. In these cases the bacteria get on the hands, instruments, or sponges, and are thus carried into the genitals, or they are expectorated directly on and into the vulva and puerperal wounds, or they settle on them from their suspension in the air as droplets or as dust.

(2) The environment has much to do with the causation of puerperal infection, and the author must here express a change of opinion from that held in 1898. In my mind there is now no doubt but that many cases of puerperal fever are due to the infected dust and air of hospitals and other places where the birth occurs. Bacteria from puerperal cases, from the dried pus of suppurations, from the autopsy room, the pathologic laboratory, and from the innumerable sources of infection of a general hospital, get into the air and the dust, and are carried by air-currents or persons to all parts of the institution, including the delivery-room and the lying-in chambers. The infection-laden dust settles on the sterilized tables, the towels, the hand solutions, and on the vulva. From here the bacteria are carried into the vagina by sterilized and gloved fingers, the instruments, catgut, gauzes, etc. Or they settle on the bed-clothing of the puerpera and thus come in direct contact with the patulous vulva, whence they wander up into the uterus. The staphylococcus is almost always found in the air of closed rooms where people congregate, but in hospitals other bacteria also are found.

The environment is a further source of danger in that the interns, nurses, servants, even the patients themselves become carriers of infection, usually in the throat and nose, as was already mentioned. Weaver found that the incidence of





water contains all kinds of bacteria, but Gehrman says he has never found the streptococcus in it.

Stroganoff proved that the bath-water obtained access to the vagina when, as in multiparæ, the vulva gapes more or less, and other laborious investigations have been made. The question can be very simply decided by asking multiparous women whether the bath-water enters the vagina. Most of them answer in the affirmative; therefore the scales of epithelium and soil from the whole body, mixed with the water, and some of the bacteria, must gain entrance to the vagina. If a woman has an ulcer or other suppuration on her body, the danger is greatest. In such cases the general bath should be forbidden. Bumm, when in Halle, reported two cases of severe vulvar streptococcus infection occurring from baths in a tub in which old culture-tubes of the streptococcus had been washed. During the process of shaving and vulvar disinfection preparatory to labor, infected hairs, scurf, suds, etc., may be carried into the gaping vulva. That puerperal infection can be carried from one patient to another on the bed-pan, douche-points, etc., is a fact known since before Semmelweis.

(4) The husband is a source of infection. Among the lowest classes coitus in the latter weeks of gestation is by no means rare, and it has been performed even during labor. Kisch refers to the practice of certain midwives who ask the husband to have intercourse with the parturient to stimulate the labor pains. In one of the fatal cases of sepsis in the dispensary service of the Chicago Lying-in Hospital the bag of waters was ruptured by the act, and the child was born before the arrival of the physician. In another coitus was performed thrice during the night, pains beginning at 3 A. M. and delivery being completed at 11 A. M. Lustgarten, Wassermann, and others have shown that the streptococcus vegetates in the urethra of healthy men, Asamura finding it in 12.5 per cent. of 112 cases, and, further, the staphylococcal group and pseudodiphtheria bacilli are often found. In the diseased urethra streptococci, pyococci, diplococci (Gram-negative), gonococci, *Bacterium coli*, and cocci which resemble the *Diplostreptococcus puerperalis* have been found. Entirely apart from the finding of bacteria in the urethra, it is certain that the penis is never sterile, and, if it were, it would carry in bacteria from the vulva, and Zangemeister has shown they may live a long time.

(5) The patient herself may carry infection to the genitalia on her fingers. I have seen severe and even fatal puerperal disease result from a carbuncle on the neck (a precipitate labor), a running ear (a streptococcal infection following influenza), ulcer of the cruris, a paronychia, and there are on record authentic instances of the transportation, by the patient, of virulent organisms from other distant parts of the body to the genitals, for example, from the purulent cavity of an artificial eye, from a weeping eczema, a mastitis, an intertrigo. How often in such cases the germs are carried by the blood-stream to the puerperal wounds, instead of by the hands, cannot be determined. It seems probable, in several reported cases of tonsillar abscess, in influenza, erysipelas, scarlatina, and pneumonia, that the infection was thus transmitted.

A suppurating or inflammatory focus in or near the genital tract is often a source of danger. In my own experience a vaginal abscess which ruptured during delivery caused an extensive bilateral parametritis; an appendix adherent to the tube caused a fatal endometritis and bacteremia; a gonorrheal vaginitis, late infection and pyosalpinx; a non-gonorrheal vaginitis, an endometritis saprophytica with toxinemias; a recto-uterine fistula, fatal peritonitis; a gangrenous myoma, a severe toxinemias; infected urine (streptococcus), septicemia and double phlegmasia alba dolens. Cases are reported of puerperal fever from ruptured appendiceal abscesses, from cystitis, from Bartholin's glanditis (gonococcus and streptococcus), from cancer of the uterus, from eczema and intertrigo pudendi, from enterocolitis (streptococcus and *Bacterium coli*). It must be added that many women affected with the diseases mentioned above go through labor without the development of infection, it being

the case that the woman's local and general immunities have been sufficiently developed to repel the invading microorganisms.

**Predisposing Causes.**—(1) Pregnancy itself favors the attack of bacteria, which is perhaps explained by the changes in the liver, in the kidneys, and the demineralization of the tissues. Animals are more sensitive to infection at this time. (2) The shock of labor, which is really a surgical operation, comprising the making of wounds, many of which are contused, and the bruising of the peritoneum, lowers the vital resistance. (3) All conditions which reduce the vitality, as profuse hemorrhages, eclamptic toxemia, coincident affections, as typhoid, pneumonia, grip, syphilis, cardiopathies, alcoholism, overwork, hunger, malnutrition, etc. (4) Lack of thyroid or action of other blood-forming glands may be operative. (5) Prolonged labor, especially after the rupture of the bag of waters, because of the frequent vaginal explorations, and the greater time and opportunity for bacteria to wander upward, increases both the frequency and the severity of the infections. Demelin, in 513 cases, has shown that, as the time elapsing increased from twelve hours to five days, the percentage of infections increased from 0.8 to 11.26 per cent. The bad influence of exhaustion deserves repetition here. (6) Operative interference, because of the wounds, contusions, and the bacteria introduced from without, increases both morbidity and mortality. Too early rupture of the bag of waters acts in this way; the hard head tears the cervix instead of dilating it softly, and, besides, dry labors often have to be terminated instrumentally. (7) Retention of pieces of placenta, of membranes, and of blood-clots favors infection, the most dangerous being the placental remnants. The glycogen and peptones of the involuting uterus produce favoring cultural conditions. Lochial retention causes fever, but is seldom continued long enough to cause real sickness. Uhlenhuth has proved that anaphylatoxin is absorbed from normal vaginae.

The author has gone rather fully into the etiology of puerperal fevers, mainly with the view to pointing out a rational prophylaxis.

**Reaction of the Organism Against Infection.**—Very properly the whole parturient canal is regarded as a wounded surface after delivery, and healing takes place in the manner of ordinary surgical wounds. The endometrium is more or less covered by a layer of necrosing decidua, but the ends of the septa between the glands are partly exposed, and when the decidua falls, they are fully exposed, but, fortunately, at this time they are protected by the bank of leukocytes beneath the surface. Under the necrosing decidua an active leukocytosis occurs, the connective-tissue cells increase in numbers, plasma cells are thrown out, all of which prevents the invasion of all but the most virulent bacteria, and, at the same time, aids in the casting off of the dead decidua. By the sixth day, in normal cases, epithelization is usually complete, except at the placental site. Here the thrombi in the open vessels require more time and different methods. The placental site is rough and raised; often is covered with irregular masses of thick decidua, tough fibrin, and sometimes even shreds of placenta or bits of villi. Organization occurs in the thrombotic sinuses; the bank of granulations thickens and causes the exfoliation of the superimposed foreign masses. This may require two weeks.

The effect of bacteria on these healing processes varies with the nature of the microorganism and the manner in which it is introduced.

If the germs are saprophytic,—that is, without invasive qualities,—they may not disturb the healing process at all; at most, if they produce caustic toxins, superficial necrosis results. Blood-clots, decomposing bits of membrane and of placenta, and dead or injured tissues harbor saprophytic bacteria. Without doubt the toxins they develop can produce cloudy swelling, even necrosis of the uppermost layers of cells, and these toxins may be absorbed into the blood, the vagina and the uterus postpartum being actively resorptive. Since some bacteria produce ptomaines and alkaloids, for example, sepsin and putrescin, these may likewise be absorbed. Under the necrotic layer a bank of leukocytes limits the further advance of bacteria. All

this is very superficial, and even sutured wounds heal in the depths—just the edges, being exposed to the noxa, may be slightly affected. More or less pus is formed on the surface, and its discharge continues until all the dead tissue is removed. Symptoms, if there are any, are due to the toxins—and few bacteria—absorbed, and the condition is called *toxemia*. Duncan named it *sapremia*.

If the bacteria are pyogenic, but without marked invasive qualities, they go a little deeper into the tissues and the wound reaction is greater. Owing to the favoring conditions of the puerperal tissues, the succulence, the bruising, with lowered vitality, and the presence of peptone and glycogen from the involuting uterus, the bacteria rapidly multiply. Their presence and their toxins cause a dilatation of the local blood-vessels, and by a positive chemotaxis phagocytes and leukocytes are crowded into the neighborhood of the invaders, and exudations rich in polymorphonuclears and eosinophiles, plasma cells, and lymphocytes are thrown out. Gradually the fixed connective-tissue cells and the leukocytes form a firm bank or granulation wall, which resists the further advance of the bacteria and prevents the absorption of their poisons. This granulation wall is composed of polynuclear and mononuclear leukocytes, eosinophiles, fibroblasts, and polyblasts. Absence or paucity of the multinuclear neutrophils and the eosinophiles, with increase of the mononuclears, indicates poor tissue reaction (Adami).

Bacteria produce poisons which may be soluble, leaving the body of the cell, or fixed in the body of the cell, being liberated when the germ dies or is broken up. The former are called *exotoxins*; the latter, *endotoxins*. Toxins may be met and neutralized by antitoxins already existent in the body or produced for the occasion. Endotoxins are not thus gotten rid of. It is believed that the bacteria, laden with poisons,—e. g., *aggressins*,—are met by certain substances in the blood-serum which cause the dissolution of the bacteria (lysins), or agglutinate them (agglutinins), or so weaken them that they may be successfully attacked by the phagocytes (opsonins). It must be remembered that, in addition to the poisons made by the bacteria, the by-products of the decomposition of the protein of the cells, ptomains and leukomains, may be absorbed. All these cellular, biochemic processes may be limited to the region around the site of entrance of the infective organisms. The outpouring of lymph may be large, the leukocytosis marked, and the swelling, therefore, be great, and all the classic signs of inflammation may be present. Here it may be best to emphasize the difference between infection and inflammation. Inflammation is the reaction of the tissues against the invasion of the noxious elements, and is nature's attempt at defense and repair. If the tissues and leukocytes are much injured by the toxins of the bacteria, or if their nutrition is cut off by the plugging of the capillaries, local necrosis—pus-formation—occurs. If not, the poisons are neutralized, the exudates are reabsorbed, the bacteria dissolved or removed by the leukocytes, which also help remove the phagocytes killed in battle, and the fixed connective-tissue cells organize into more or less permanent fibrous tissue, leaving scars. During all this process toxins—and a few bacteria—get into the blood, producing general symptoms—fever, rapid heart, prostration, etc. The process is, however, quite local, and the condition is still called *toxemia*.

If the invasive power of the bacteria is very great, a quality of certain strains of streptococcus, even the intact vagina may not be able to withstand the attack. The streptococcus' *aggressins* drive away the leukocytes, and itself quickly invades the lymph-vessels, into the subcutaneous and submucous tissues, multiplying rapidly. Within an hour after inoculation (some say a few minutes) it is beyond the reach of the most powerful antiseptic, and the result to the patient depends on her power of resistance. The battle between the streptococcus and its toxins—streptococlysin, leukocidin, etc., with the patient's leukocytes, and immune bodies, alexins, etc.—is soon transferred to the blood itself, and a real *bacteremia* occurs. Latterly, the view is gaining ground that the symptoms and results of infection are anaphylactic in nature, the foreign protein being derived from the splitting of the bacterial albu-

min by ferments produced by the animal cells sensitized against the bacterium. (See Vaughan.) (It is possible, in a text-book of this nature, only to indicate the processes involved. For full information the reader is referred to works on immunity and general pathology, such as those of Ricketts and Adami.)

The *Streptococcus pyogenes*, discovered by Mayerhofer in 1865, cultivated by Pasteur in 1879 from the blood of women dying from puerperal fever, and isolated in pure culture by Ogsten in 1883, is the cause of the majority of the cases of infection after childbirth. It gains entrance at any point of the parturient canal, passes at once into the lymph-spaces and along the capillaries into the blood-stream, without producing much local reaction. Serous and seropurulent exudate may be slight or much, depending on the virulence of the invader. The streptococcus, unless of minimal virulence, does not produce soluble toxins, but its body contains hemolysin and leukocidin, although the actual toxic agent is unknown. Various forms of streptococci—the *Streptococcus longus*, *S. brevis*, *S. erysipelatis*, *S. capsulatus*, *S. viridans*—are the result of different cultural conditions within and without the body. Hemolysis is not a constant characteristic, and does not indicate excessive virulence, nor does the length of the chains, although usually the long chains are the most dangerous. As was already stated, the streptococcus may be found in the vagina of many apparently healthy women. It exists in a state of very low virulence as a saprophyte. By proper cultural treatment it may be made very active and extremely pathogenic for animals. We have an analogon in the case of the human when streptococci, made virulent by "passage" through one puerpera, are introduced into the genitals of another, there causing a violent infection, or when they are carried from the inflamed nose or throat of an attendant to the puerperal wounds. All forms of puerperal infection, from a simple toxinemia from retained lochia to the bacteremias which may be fatal in a few hours, may be produced by the streptococcus. Which it shall be depends on the natural strength of the inoculated coccus, the natural resistance of the patient, the number of the bacteria introduced, the concomitant injury of the tissues, the location of the point of entrance, and the time of the infection. Severe disease will result if only a few chains of a highly invasive organism are introduced, or if the woman's resistance happens to be very low at the time, as by hemorrhage, shock, renal or hepatic disease, etc. If the tissues are much bruised by labor, they are not in condition to resist invasion by even a mild streptococcus. If the germs are deposited near the peritoneal cavity, for example, in a deep cervix tear, or on the thrombi of the placental site, dangerous infections, peritonitis, and metrophlebitis are more apt to follow than if they were inoculated into a perineal laceration. If the inoculation occurs late in the puerperium, the lymph-vessels are quite closed, the blood-vessels sealed, the local immunities well developed, and the surface well protected by a granulation wall—all of which preserves the patient from invasion. The severest fevers result from direct inoculation of the endometrium and placental site during labor itself. Then, too, as Rosenow has shown, there are many strains of streptococci, each one capable of producing a peculiar localization of infection. I believe this is true also of the staphylococcus, as I saw one epidemic of mastitis caused by a staphylococcus which apparently had an affinity for breast tissue only.

The *staphylococcus* was separated from the streptococcus by Ogsten in 1883 in purulent affections. Doléris found it in 1880, and Brieger, in 1888, demonstrated the *Staphylococcus aureus* in five fatal cases of puerperal infection. All the staphylococcus group—*Staphylococcus aureus*, *albus*, *flavus*, and *citreus*—have been found in these cases, and occasionally one or the other is associated with the streptococcus (Bar, Tissier, the author). Members of the staphylococcus group, called briefly pyococci, are less invasive than the streptococcus. They elicit marked leukocytosis, but, possessing leukocidin and proteolytic ferment, they kill the leukocytes and liquefy the tissues, producing pus. They produce soluble toxins, hemolysin and

leukocidin, and true exotoxins, which elicit the antitoxins of the blood, but the virulence of the germ depends not on these, and since an endotoxin has not been demonstrated, again we are at a loss to explain their toxicity. Local and general leukocytosis characterizes infections with this bacterium, and, contrary to a general belief, severe and fatal puerperal fever can be caused by it, as one of my cases proved, although this is unusual.

*Pyococci* are found on every vulva and in most vaginas before and during the puerperium, but they live as harmless parasites, unless their virulence is exalted by accidental conditions. They may cause suppuration in perineorrhaphies, non-union of cervix tears, and are responsible for many cases of parametric abscesses and of slow pyemia, but, as was said, they may cause any and all the forms of puerperal fever which the streptococcus can produce. The organism reacts against invasion of the pyococcus by phagocytosis, and by means of antibacterial products present in the serum, and thrown off by the leukocytes, which are perhaps of the nature of opsonins.

The *Bacterium coli commune*, or the colon bacillus, is the exponent of a group of organisms inhabiting the intestinal tract, and has been repeatedly found in fatal cases of puerperal infection. In one case it was introduced by the gauze used for the packing of the uterus, the patient having a diarrheal evacuation at the time, unobserved by the operator. Gebhard demonstrated the *Bacterium coli* in a case of tympania uteri which I had the privilege of observing, and Widal, Bar, Durante, and von Franquè have proved it causative of puerperal infections. Bar called attention to the "colibacillose gravidique," which manifests itself as appendicitis, cholecystitis, or uteropyelonephritis. It may cause general septicemia, with or without metastases, endocarditis (Rendu), meningitis, otitis, peritonitis (but the local symptoms are minimal), and phlegmasia alba dolens (Jeannin). Usually the infection is local, causing decomposition and suppuration, with fetid lochia and toxinemia. It is often associated with the streptococcus, and the symbiosis exalts the virulence of the latter decidedly (Bar and Tissier).

The *gonococcus* was proved by Krönig, in 1894, to be responsible for many cases of puerperal infection. It acts in two ways—first, by preparing the tissues for the invasion of other organisms, and by symbiosis exalting their virulence, as well as its own, or it takes a leading rôle itself. In a fatal puerperal infection I demonstrated the gonococcus and the streptococcus in the peritoneal exudate. Hallé and Rendu, Harris and Dabney, have shown that it can cause general septicemia with endocarditis. Metastases may occur in the joints, resembling those of pyococcal and streptococcal infections, and in the eye, brain, skin, bones, pleuræ, etc., but usually the processes are local, that is, acute urethritis, endometritis, salpingitis, pelveoperitonitis, parametritis, and ovarian abscess. A latent, apparently cured gonorrhea, may, as the result of the traumatism of labor and the favorable cultural conditions of the puerperium, become acute and progredient. The gonococcus produces no exotoxin, but contains endotoxin, which is leukotactic, yet the bacteria seem to harm the leukocytes but little. Infections with the gonococcus develop pus and purulent exudates, the general toxinemia being mild and the course of the disease usually favorable, though protracted. Owing to the slow growth of the organism, the morbid manifestations usually appear late in the puerperium.

Many other well-known bacteria have been found as the agent of more or less severe puerperal infections. The *Bacillus pyocyaneus*, a dangerous organism for children, rarely causes trouble with the mother, but when it does, the reaction is usually severe, with high fever, much prostration, hemorrhagic diathesis (*pyocyaneus* hematoxin), and splenic tumor. Symbiosis exalts the mutual virulency. In one case of severe puerperal infection I found the pneumococcus. It is impossible clinically to distinguish this infection from those due to other pus cocci; indeed, bacteriologically, transmutations occur.

*Bacillus Typhosus*.—In 1898 I found, in the uterine lochia of a puerpera who was ill, apparently with typhoid, a culture of the *Bacillus typhosus*. The Grubbaum-Widal reaction was very marked in her blood. An internist, on the general symptoms, would not make a positive diagnosis of *entero*-typhoid, while the local findings—large, tender uterus—pointed to an infection. The disease terminated by lysis, and I believe this case is similar to one observed by Williams in the same year.

The *bacillus of tetanus* has repeatedly been demonstrated in puerperal tetanus (*vide infra*), and the Klebs-Löffler bacillus of diphtheria has been found in true diphtheric exudates on the puerperal wounds. Over 42 cases of true diphtheria infection in the puerperium are on record (Bourret). The streptococcus and the staphylococcus, especially in association with bacilli of the colon group, may produce grayish, greenish, or yellowish pellicles on the vulva and vagina, but these are not so thick as those due to true diphtheria, and they are more adherent to their base. Bacteriologically, they are easily differentiated.

Bacteria of decomposition and putrefaction, of which there is an immense host, may, if given proper conditions,—large amount of dead material to feed on, insufficient drainage,—produce serious, even fatal toxinemias. They produce toxins (sepsin), and these, with the by-products of their action on albumin (ptomaines, leucomains, etc.), being absorbed, cause chills, fever, vomiting, stinking diarrhea, prostration, delirium, etc. Duncan gave the name “sapremia” to this condition, and if thus restricted, it is a term which ought to be retained. Many authors use the term as synonymous with toxinemia from all local causes. These putrefactive bacteria are legion, anaërobic and aërophile. Von Herff says that there are nine forms of streptococci among the aërobic saprophytes, together with the *Bacillus coli*, the *Bacillus aërogenes capsulatus*, the *Micrococcus foetidus*, *Staphylococcus parvulus*, *Bacillus radiiformis*, *Bacillus nebulosus*, *Bacillus racemosus* (habitual in gangrenous processes), *Bacillus caducus*, and others. As a rule, these bacteria possess no invasive power, but some, the *Bacillus coli* and the *Bacillus aërogenes capsulatus*, the *Streptococcus putridus*, may break through the leukocyte wall into the lymphatics and the blood. If there is much dead or deeply injured tissue about, these bacteria may produce putrid gangrene, as in putrid endometritis, and the absorbed toxins may be fatal. Sometimes living tissue will succumb to the gangrene-producing bacteria and slough off—metritis desiccans. It is almost invariable that the streptococcus and staphylococcus—indeed, any germ which takes the leading rôle in a given infection—will have, in symbiosis, one or many of the putrefactive bacteria. Hüssy found anaërobes in several fatal septicemias.

Gas-forming organisms are often found in cases of fetid and frothy lochia. Dangerous gas builders are the *Bacterium coli*, the *Bacillus aërogenes capsulatus*, *Bacillus œdematis malignus*, and the pseudobacillus of malignant edema. Of these, the best known, through the labors of Welch and Williams, is the *Bacillus aërogenes capsulatus*, which is perhaps identical with the “vibrio septique” of Pasteur and Dolèris. If it invades the tissues, these become emphysematous and gangrenous; if the blood, the vessels are full of frothy blood, and the liver and the spleen become spongy with gas. The body swells up with general emphysema, and there are hemorrhages and icterus. Some cases of so-called air embolism are really infections of this sort. It is rare to find this organism alone—usually the pyocyanus, the proteus, the *Micrococcus foetidus*, other gas-forming bacilli, and especially the *Streptococcus pyogenes*, are found in association. The symbiosis makes the germs mutually highly virulent and the clinical pictures intensely complicated. If these gas-builders once get beyond the confines of the surface of the genital tract, they usually evince terribly invasive qualities, leukocytosis is scant, and toxinemia rapid and prostrating. The heart is quickly depressed, hemolysis occurs, with jaundice and bleeding into vital organs, the serous surfaces, and the skin.

Finally, in many cases of puerperal fever bacteria have been found which cannot

placed in our present nosology, and many occur which cannot be grown on our own media.

**Classification of the Forms of Puerperal Infection.**—Puerperal fever is a protean case. As may be seen from the above, many bacteria, single and in combination, may be operative, and these may produce local and general infections, both mild and severe. Women react differently to these various agents—some possess immunity, other a weakness against particular bacteria. Some possess idiosyncracies to the toxins produced by certain bacteria. Diseases of the vital organs alter the general reactions of the system against invasion, and there are many other conditions which make the clinical pictures exceedingly complex, so that a perfect anatomic and pathologic diagnosis may rarely be made. For the same reasons no classification of them so far offered is entirely satisfactory. We may now appreciate the achievement of Semmelweis, since he saw, through the maze of apparently divergent pathologic processes, that they all were due to one underlying cause—wound infection and resorption.

A classification founded on the bacteriology, a botanic or biologic classification, would be the most scientific, but, clinically, this is impractical because—(1) Several (from 1 to 15) different organisms may combine in producing the symptoms; (2) one organism can produce several different forms of puerperal disease and differing degrees of severity; (3) the organism which may be isolated from the lochia or the blood, though it often is, may not be, the cause of the morbid process; (4) it may not be possible to identify the germ which is causing the worst symptoms, or even discover it at all.

Another classification is that based on anatomic pathologic findings, and which divides the cases strictly according to the parts involved. Thus there are vulvitis, vaginitis, endometritis, parametritis, perimetritis, metrophlebitis, etc. Clinically, this is better, but not all the forms of puerperal fever are localized to the sites at which the infection enters—a general sepsis may occur from a frenulum tear, and any of the germs mentioned may gain entrance at any place in the genitals and produce various and complicated symptom-complexes, and, further, the simple knowledge of the site of the disease is not a sufficient guide to a rational treatment. To say, for example, that a woman has endometritis is by no means enough.

Crèdè divided the cases into local and general infections, a plan which Olshausen and Bumm, to a certain extent, have followed. Bumm first describes the cases of "wound intoxication," or toxinemia, which is similar to the sapremia previously defined, and then mentions "wound infection," which he divides into—(1) the local processes in the perineum, the cervix, and the endometrium; (2) the spreading of the infection beyond the wound—(a) through the blood-vessels, causing septicemia, thrombophlebitis, pyemia; (b) through the lymph-vessels, causing perimetritis, parametritis, metritis desiccans, etc.

The division of the cases into three forms—*sapremia*, *septicemia*, and *pyemia*—is an old one, and inappropriate. Sapremia has already been defined. It had better be replaced by the term toxinemia, or "septic intoxication." Septicemia or sepsis means the absorption into the blood of living ferments—bacteria, which, multiplying there and in the fine capillaries, produce intense morbid changes, either by the toxins or by capillary embolism and thrombosis. A better term is bacteremia, septicemia being etymologically incorrect. Pyemia literally means pus in the blood, and in some cases it may be appropriate, and if it is understood to apply only to those cases where suppurating emboli break loose from an infected thrombus in a vein, producing distant purulent metastases, it may be retained. It were better, however, to replace it with the term metastatic bacteremia, because this describes those cases where the bacteria themselves are transported from the infected thrombus. These three clinical forms almost never exist alone, but are combined. It cannot be doubted that in all local infectious processes many bacteria get into and



are killed in the blood-stream. The culture of the germs from the blood, therefore, is not positive evidence of progressive bacteremia. In all bacteremias there is also toxinemia, from toxins both developed in the blood and absorbed from the site of entrance of the germ—the wound infection. As was shown above, the streptococcus, the pyococcus, the colon bacillus, the capsulated gas bacillus, and many others may play the rôle of a saprophyte, or may, as the most invasive infectious agent, cause a mild toxinemia, a deadly bacteremia, or a metastatic bacteremia. It is evident now that a generally applicable single classification is impossible, and for the purposes of nosology in practice it will be necessary to state—(1) The site of the entrance of the infection and its course; 2. the extent of the infection, whether mainly local or already generalized; (3) the kind and degree of virulence of the germ which is causative. It may not always be possible to get all this information. Our diagnoses will read like the following examples: Toxinemia due to vulvitis—*Staphylococcus aureus*; toxinemia due to placental fragments and saprophytic organisms; toxinemia—and perhaps slight bacteremia—from parametritis—streptococcus; bacteremia from endometritis—streptococcus, virulent; metastatic bacteremia from metrophlebitis—*Staphylococcus aureus*, mild; and so on.

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## CHAPTER LXIV

### CLINICAL TYPES OF PUERPERAL INFECTION

**EVEN** though it is usually impossible clearly to distinguish between a retention of toxinemia and an infection or bacteremia, and even though in practice the various forms of puerperal infection to be mentioned may merge into each other, still they often present clinical pictures which are fairly characteristic and typical, and sufficiently sharp for diagnosis, prognosis, and treatment. The following are the forms of puerperal infection most commonly met, being placed about in the order of their frequency: vulvitis and colpitis; endometritis, mild and malignant; retention intoxication (the sapremia of Duncan, or toxinemia, from material pent up in the genitalia); parametritis; peritonitis, pelvic or general; true bacteremia or septicemia; metastatic bacteremia or septicopyemia; phlegmasia alba dolens; endocarditis; tetanus genitaliæ; diphtheria genitaliæ.

**Vulvitis.**—Causes are traumatism during labor plus infection. Previous disease predisposes—for example, bartholinitis, abscess, fistulas, etc. As a rule, after operative deliveries there are more or less contusion of the parts and many little wounds and abrasions. If a perineorrhaphy has been done, the possibility of wound infection is greater. The alkaline blood and serum permit the saprophytic streptococci and other bacteria to regain some of their virulence, and it is not unusual to find these wounds covered with grayish or greenish exudates, and even superficial ulceration may occur. These are called "puerperal ulcers," and are often accompanied by pronounced swelling of the whole vulva. In from six to eight days the swelling subsides, the superficial sloughs are cast off, pink granulations pushing up to the surface, and epithelization rapidly takes place, scar formation being slight. If the perineorrhaphy wound becomes infected, the parts are swollen, with a brawny exudate; the edges of the wound are red, their line of apposition not united, but separated by pus and sloughing tissue, serum and pus oozing out of the stitch-holes.

**Symptoms.**—If the drainage is free, there are no marked symptoms. The patient complains of burning on urination, more or less inability to urinate, pain and discomfort from the swelling, with a sense of local heat. The temperature is seldom raised above 101° F., the pulse above 100. If suturing prevents the exit of the infected exudations, or if the infective agent was an alien streptococcus, a sharp chill and fever, even of 104° F., may usher in the disease; the pulse may go above 120, and this may be the starting-point of a general bacteremia.

**Vaginitis.**—The causes are the same—too much traumatism during labor plus infection. Too prolonged labor, too frequent examinations, the use of very hot douches or of too caustic antiseptics, prolonged application of the colpeurynter, of gauze packing, bruising from brutal operating, cutting by the forceps, by spiculæ of bone in craniotomy, the retention in the vagina of blood-clots, membranes, gauze sponges, etc.—all these favor infection by producing conditions which develop the virulence of the germs normally present in the vagina (for example, the streptococcus and the staphylococcus). If, in addition, alien bacteria are introduced, the woman seldom escapes a dangerous malady, because they find ideal conditions for their growth in the contused tissues bathed in an alkaline blood-mixture containing much dead material, that is, the lochia. Astonishing are the recuperative powers of the vagina in the absence of hetero-infection.

If the vagina were opened to view by specula (which is contraindicated), the usual signs of inflammation would come into view, with many puerperal ulcers discharging purulent secretions. If many injuries had been laid, the wounds will be seen, their edges covered with sloughs, and an infiltration extending around the vagina, even to the walls of the pelvis, and a lymphangitis may also be found. These wounds heal by granulation, with the free discharge of sometimes foul-smelling pus, and leave cicatrices which may extend to the base of the broad ligaments, to the periosteum, or under the base of the bladder, causing fixation and distortion of the pelvic viscera. Alien bacteria, especially the streptococcus, may cause pericolicitis, peritonitis, and even bacteremia. The symptoms are severer than those of vulvitis, especially if the causative bacteria are invasive or produce much toxin. If drainage is free, the general reaction is usually mild; if the discharges are retained (a condition called *lochiocolpos*), severe toxinemic manifestations arise (*vide infra*).

The diagnosis of vulvitis is easily made by inspection of the vulva. This is a good place to call attention to the value of the signs present on the vulva indicating infection higher up. Early in the disease the presence of puerperal ulcers may be very significant of grave infections involving the uterus. The infectious lochia washing over the vulvar wounds almost always cause superficial necrosis. As the disease heals the local signs disappear. Vaginitis is never present without some inflammation of the vulva.

**Treatment.**—Douches, internal examinations by the finger or with specula, are contraindicated. If the retention of a gauze sponge is suspected, a rectal examination will disclose it. If there are sutures in the perineum, they are to be removed on the first suspicion of an infection. To leave them in the hope of getting a union in spite of the infection is to trifle with an unknown foe, and usually be defeated in the end. If the confined infective exudates do not cause paracolpitis, parametritis, or even general infection, the tissues break down into pus which escapes into the vagina, and the skin only uniting, prolapsus vaginæ and descensus uteri follow, nevertheless. After removal of the sutures and opening up the recesses of the wound widely the latter may be flushed with tincture of iodine, and a thin strip of gauze laid between its edges to keep up drainage. External flushings with a weak antiseptic are frequently practised, but no vaginal douches, since these may carry the infection higher. Ergot and hydrastis, 15 minims of the fluid extract of each, are given four times daily, the bowels are kept free, and hexamethylenetetramine, 5 grains four times a day, exhibited, if there is the least indication on the part of the bladder. I often use the latter as a preventive. For the relief of local pain and discomfort a warm wet boric or lead-water dressing may be used.

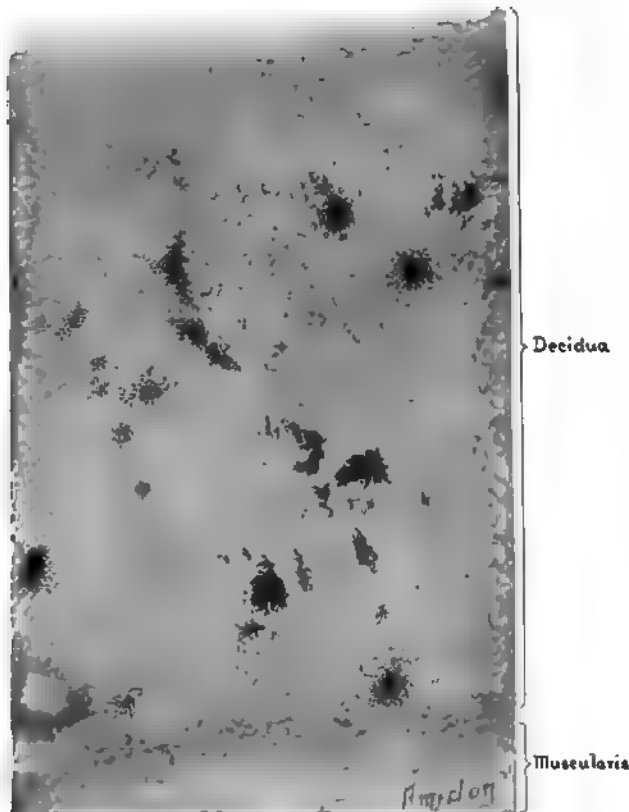
**Endometritis.**—Very few puerperal infections occur without involvement of the endometrium. Indeed, the cervix and endometrium are the ports of entry to the parametrium, the perimetrium, the tubes, and the shortest way to the blood itself. The reasons for the frequent involvement of the endometrium are: (1) The cervix and the lower uterine segment are particularly exposed to the traumatism of labor and of operative delivery; (2) the mucous membrane is very delicate in structure as compared with that of the vagina, and it is covered with a layer of dying decidua, favorable to the growth of bacteria; (3) blood-clots, membrane, even placental fragments, may be retained; (4) the infection may have been present in the endometrium during pregnancy (see Microbic Endometritis, also Curtis), or brought there directly by colpeurynter, bougie, or decomposed liquor amnii; (5) shreds of membrane hanging down in the vagina act as a bridge on which the bacteria mount into the uterus; (6) the open vessels of the placental site are particularly favorable to the nidation of germs; (7) if the uterus is flabby and relaxed, stasis of the lochia may occur, a condition particularly favorable to bacterial growth.

It must not be supposed that the presence of decidua or even a piece of placenta in utero means that it will cause an endometritis. The infection must also

sent. Pieces of placenta can remain in the uterus for weeks without decomposing, until, after a careless examination, the infection begins.

The importance of a well-contracted uterus was recognized even in the olden

A uterus that is relaxed absorbs very actively toxins produced in its interior, and it allows them to accumulate here. A well-contracted uterus expels discharging clots, secretions, etc., and, in addition, has less absorptive power, since blood-vessels and lymphatics are held closed. If the uterus becomes bent on at the cervix, especially after the sixth day, when the uterus, being strongly contracted, may catch behind the symphysis, or if retroflexed, under the promontory the lochia may be pent up, and a condition analogous to lochiocolpos results.



—DECIDUA IN SIX-WEEKS' ABORTION. DECIDUA ONLY INFECTED. EOSIN AND METHYLENE-BLUE STAIN (specimen presented by Dr. Reinhart). See detail in Fig. 740.

more common than this, and is called *lochiometra*. It usually causes a severe and rise in temperature, which go down just as quickly if the cause is removed. *Pathology*.—To avoid repetition, the reader is referred to p. 213 for a description of puerperal changes in the normal uterus. In endometritis the mucous membrane is swollen, rough, covered with thickened decidua in a state of necrosis, and the surface is moist, with a mucopurulent, sometimes hemorrhagic, smeary material. The cervix is almost always involved in the same way; it is swollen and eroded, and, in addition, the wounds are covered with puerperal ulcers. Involution becomes arrested, and the uterus becomes edematous and relaxed, giving the germs ready access to the blood. Bumm distinguished two forms of endometritis—first, that due to a local or bacillary infection, in which the bacteria were limited to the surface and necrotic material there by a protecting bank of white cells and granulations,

and, second, a coccal or septic infective form, where the bacteria, usually streptococci and pyococci, invade the lymphatics and blood-vessels after overcoming the bank of leukocytes and granulations. After examining many specimens I was

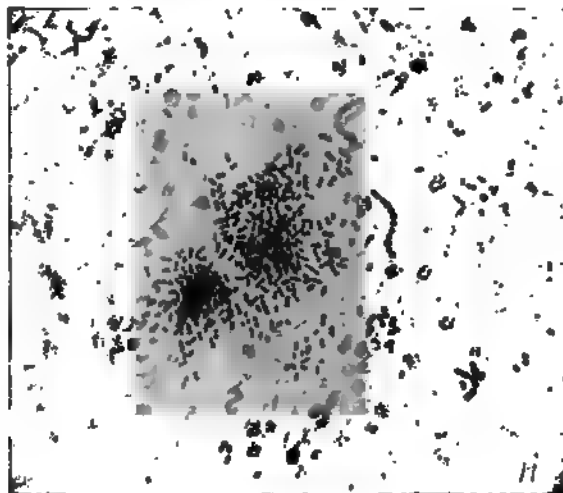


FIG. 740.—BACTERIA IN INFECTED DECIDUA. HIGH POWER. EOSIN AND METHYLENE-BLUE STAIN.

to find only one where the bacteria were limited to the surface (Figs. 739 and 740). In the putrid endometritis the surface of the endometrium is covered with a fetid material, often containing gas-bubbles, and of a grayish or yellowish color—even black from decomposed blood. It is impossible to wipe the

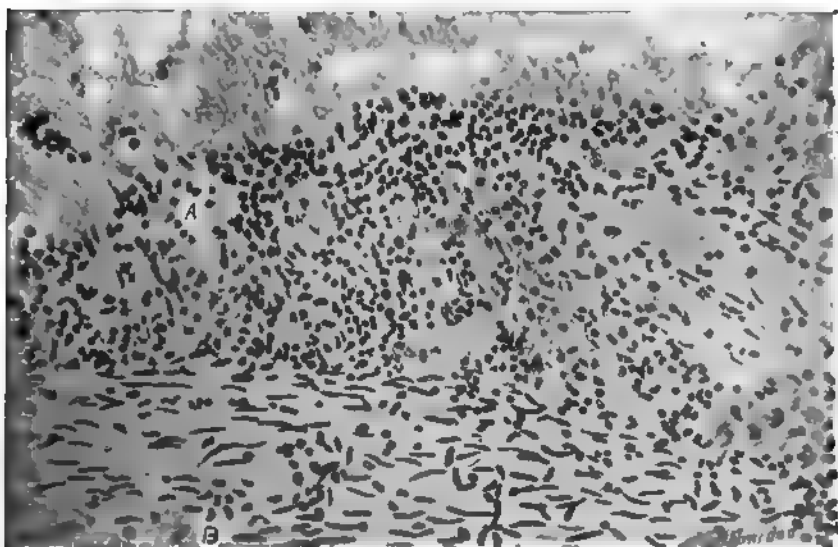
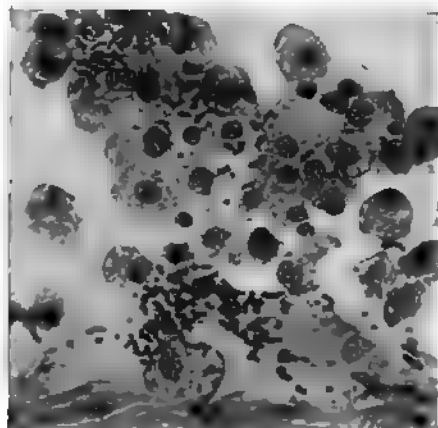


FIG. 741.—POSTPARTUM ENDOMETRITIS (STREPTOCOCCI).

Granulation wall in endometrium. Hematoxylin and eosin stain. Bacteria have passed through this place. See Figs. 742 and 743, which were taken from the places here indicated by A and B.

smooth, as in the normal uterus. If the bacteria are more virulent, they cause actual sloughing of the endometrium, with many superficially ulcerated areas, covered with a diphtheroid (not diphtheric) exudate, and the whole interior of the uterus has a putrescent appearance and odor—putrescentia uteri. Usually the

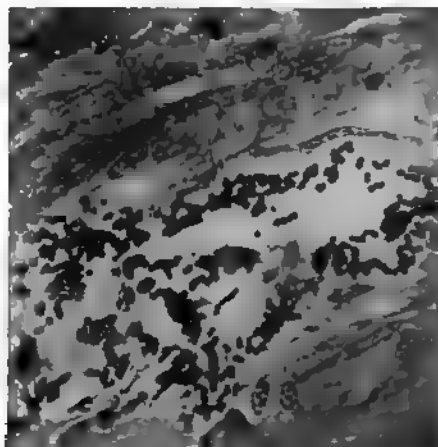
bacteria of decomposition are here associated. If the gangrene goes deeper into the wall of the uterus, an evidence of still greater virulence of the bacteria (certainly anaerobes), larger or smaller portions of the lining of the uterus, or the muscle itself, may slough off—the metritis desiccans of Garrigues. He showed that the majority of cases of endometritis putrida were due



742.—STREPTOCOCCI AMONG DECIDUAL CELLS. ENDOMETRITIS POSTPARTUM, GRAM STAIN.  
From point A in Fig. 741.

to a virulent anaerobic streptococcus. He demonstrated this coccus in parametritis, in pyosalpinx, and in the blood of cases which formerly had toxemia.

Infections due to *Streptococcus pyogenes* and the pyococci alone do not produce fetor, and the surface of the uterus is usually smooth and not deeply



743.—STREPTOCOCCI IN UTERINE MUSCLE. ENDOMETRITIS POSTPARTUM, GRAM STAIN.  
From point B in Fig. 741.

In rare instances the infection is limited to the placental site, being mild, due to a pyococcus of attenuated virulence, and producing little inflammation, but often protracted forms of metastatic bacteremia. (See

the wounds about the vulva are covered with a diphtheroid exudate, forming the puerperal ulcers already mentioned.

Unless the infection is very virulent, the symptoms and objective signs are no more threatening than described; the temperature, after pursuing a remittent ( $1^{\circ}$  to  $2^{\circ}$  F.) course for four or five days (Fig. 744), subsides by lysis, the pulse slows, and in six to ten days recovery is established. If the infecting bacteria are strong enough to overcome the protecting wall of leukocytes, the blood is involved and the general symptoms are marked, the case having become a bacteremia (see below).

**Diagnosis.**—Endometritis has no characteristic symptoms. With the usual manifestations of infection one finds a large, sensitive uterus, evidences of slight peritoneal irritation, and altered lochia. The vulvar wounds have an unhealthy aspect, except when the endometritis is due to non-virulent saprophytes, in which case these wounds may heal under healthy granulations. If a specular examination is made, the condition of the cervix will be a criterion of the condition of the endometrium. The lochia in the putrid infections are profuse, thick, and foul, while in the streptococcic kinds they are diminished, thin, sanious, with an acrid odor. The absence of signs of peritonitis and of tumor eliminates localization outside the uterus. Prognosis and treatment will be discussed later.

**Sapremia, Retention Fever, Toxinemia.**—Clinically, a not small group of cases exists with fever and often very threatening symptoms, due to the absorption of toxins from decomposing material in the genital tract. Lochiocolpos and lochiometra have already been referred to. If the toxins were always the result of the action of saprophytic bacteria, the organisms of putrefaction, the term sapremia, proposed by Duncan, would apply. But the streptococcus and other cocci and bacteria may grow in the dead tissue and produce toxins, which are absorbed, and, further, the author would rather agree with Schottmüller, Latzko, and Zangemeister, as opposed to Döderlein, Bumm, and others, that in all these cases many bacteria get into and are killed in the blood. The distinction, therefore, between toxinemia and bacteremia is mainly one of degree, and the term sapremia must be limited to those infections where only putrefactive organisms are present. We use the terms septicemia and sepsis in a very loose way to mean a bacteremia by the pus-cocci, when the Greek original means putridity. We might also thus use the term sapremia, but it would be better to discard all three, which, however, at present is impractical.

When a puerpera develops fever, which by exclusion is found to come from the genitals, the first question that arises is, Is there anything in the uterus? If there is a piece of placenta, a clot, or a mass of membranes in the uterus, the same may not become infected if the uterus is firmly contracted and if no alien bacteria are carried in from the outside. Should it become infected, the symptoms are those of endometritis, and there is always more or less reaction in the endometrium.

Another danger of these infected, necrosing bodies lies in their providing a favorable nidus for the virulent streptococcus, in developing the virulence of weakened cocci, or native bacteria, or in altering the subjacent mucosa, so that it offers less resistance to the microorganisms normally present in the vagina, cervix, and uterus. Bacteremia has often followed, but in most cases the disease remains local, and there is no marked invasion of the lymph- and blood-streams.

**Symptoms.**—It is impossible to distinguish this condition from an endometritis, since the symptoms are nearly identical. Lochiometra and lochiocolpos are characterized by absence of the lochia. If a piece of membrane or placenta has been retained, the after-pains often continue until it is expelled, after which also the fever and rapid pulse subside. Profuse and very bloody lochia are the rule if portions of the placenta are retained, and repeated hemorrhages or the passage of clots are almost pathognomonic. The uterus is large and soft in such cases. As an aid to the

netrium, and, finally, they may wander into the subjacent tissues from the uterine tube or the tubes, which may be infected.

Usually always it is the *Streptococcus pyogenes* which is the causative organism, but a staphylococcus has been found, and a colon bacillus, though usually a comitant infection, and even a coccus (Menge and Döderlein). Factors favor infection of the uterine tissue in the pelvis after delivery. Besides the general softening of the tissues, the increased vascularity and imbibition of the tissues, the relaxation of the connective-tissues, and the increased vascularity to pregnancy, there is the swelling of the parts, with the increased serofibrinous extravasation. To these must be added the introduction of alien bacteria through lacerations in the perineal spaces, by means of the instruments, gauze, etc.

**Pathology.**—Cellulitis in the pelvis

very little from cellulitis under the skin or elsewhere. The bacteria, by their action and the toxins they produce, irritate the tissues, a protective serum is poured out (inflammatory edema), leukocytes hurry to the scene, the binding cells

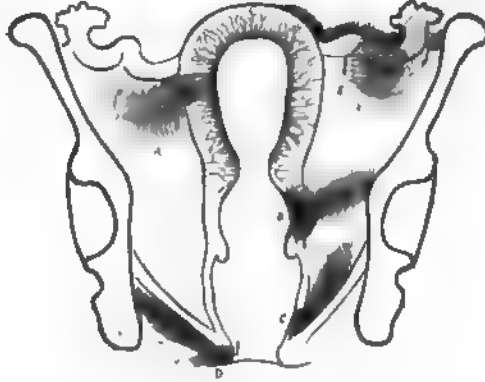


FIG. 746.—DIRECTIONS TAKEN BY THE BACTERIA TO REACH THE PELVIC CONNECTIVE TISSUE.

A, From endometritis through uterine wall; B, from cervix tear. C, from vaginal tear above levator ani; D, from perineal tear; E, downward from peritonitis.

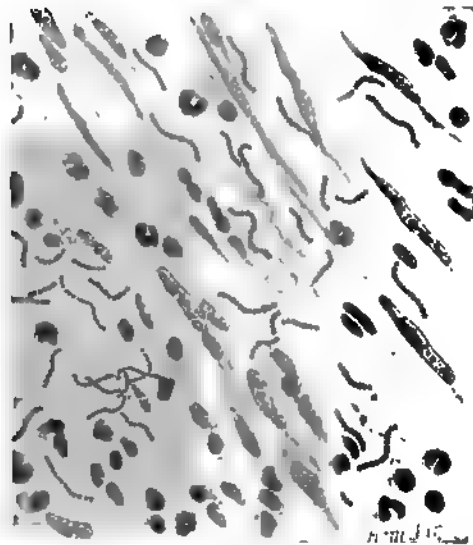


FIG. 747.—PARAMETRITIS PUERPERALIS. In a specimen of Dr. Ries'. Streptococci in the tissues.

proliferate and form fibrin, all of which compose an exudate in the infected area. The bacteria pass along the lines of least resistance, and these are the natural planes of cleavage of the pelvic connective tissue, and are limited by firm layers of fascia and by the organs in the pelvis. The inflammatory exudates, therefore, following the infection will extend in certain directions, passing along the planes of fascia, and surrounding and embedding the hollow pelvic organs. Since the inflammatory reaction is sometimes excessive, the amount of serum and fibrin and cellular infiltration may overfill the tissue-spaces, and the exudate itself may wander. On the other hand, the bacteria may select an unanatomic

or example, through a fascia or muscle, and then the inflammatory will be found where it was not expected. Von Rosthorn's classification of exudates is the most practical: (1) Lateral horizontal exudates located between the layers of the broad ligaments, with a tendency to spread to the side walls of



the pelvis and around the cervix; these usually come from cervix tears; (2) high intraligamentous infiltrations beginning near the cornua uteri, forming tumors, rounded above, with a tendency to unfold the broad ligaments and climb up into the iliac fossæ; these usually come from endometritis; (3) exudates in the retrocervical connective tissue, with a tendency to spread either posteriorly along the uterosacral ligaments or sink in the rectovaginal septum; (4) exudates in the precervical tissue, and spreading toward the sides, around the ureters; (5) exudates anterior to the bladder, behind the pubis, with the tendency to rise behind the recti muscles, even to the navel—"plastron abdominal" of the French. Several of these forms may be combined. The most common is the lateral, extending from the side of the uterus to the bony pelvic wall, then anteriorly around the ureter, raising the peritoneum up and appearing above Poupart's ligament. Rarer distributions are: Posteriorly, to the sacrum and up to the kidney, or even to the diaphragm and through it; laterally, out through the sciatic foramen into the thigh; or inside the infundibulo-pelvic ligament along the psoas, involving the tissues around the lumbar plexus of nerves.

The exudation varies in extent and consistence, depending on the virulence

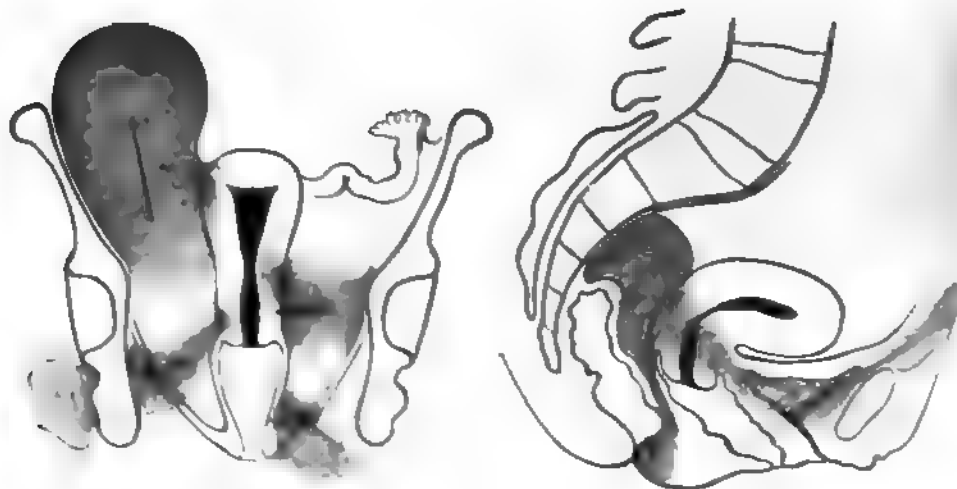


FIG. 145.—Puerperal exudate in retrocervical space. FIG. 146.—Other distribution of puerperal exudate.

of the germ and the resistance of the patient. In mild cases there is only a simple inflammatory edema, and in the severest cases also the process is limited to a serous and partly cellular infiltration, the bacteria passing quickly through the lymphatics into the blood. Most often there is a moderate reaction, with the formation of large exudates. If a section is made through the inflamed tissues at the side of the uterus the lymph-vessels will be found thickened, tortuous, and beaded and a profuse flow of shaggy exudates from numerous fine openings. Around the exudates is a soft, gelatinous surface, a glistening, glassy, moist appearance. Later when the exudate has dried the exudation solidifies the tissue and makes it crumbly. The vessels are not torn away, and if they were primarily infected or overgrown by bacteria, the bacteria may in large numbers degenerate and be discharged into the blood, the organism itself acting as a filter. Later, when stimulating of the serous membrane has been exhausted, the same lengthening of the vessels and a varicose swelling of the lymphatics may be seen, with its various results. Improbable as it may seem, the bacteria may result in their partial destruction by the action of the lymphatics with recovery or compensation of function.

The peritoneum of the pelvis always takes part in the inflammation; the tubes and ovaries are matted to the broad ligaments or the uterus, and the intestines are adherent to the pelvic masses of exudate. It may be difficult to say whether the parametritis or the perimetritis is of greater moment.

Nature cures these cases in two ways: Either the exudates are reabsorbed or they suppurate. In the latter instance the pus is discharged externally or encapsulated, or complete resorption occurs. If resolution takes place, the exuded fluids are absorbed, phagocytes attack the fibrin and detritus (the dead leukocytes and dead bacteria), and digest them or carry them off. The new-formed connective-tissue cells make the scar tissue, and fibrous bands, and cicatricial thickenings which mark the site of the inflammation. These cicatrices distort the pelvic organs, as regards position, shape, and function. The uterus is sometimes found drawn over to one side of the pelvis, and moored here immovably; or it may be drawn up toward the sacrum by the shortening of the uterosacral ligaments—Schultze's antelexion,—or it may be twisted on itself. Sometimes the neck of the bladder is pulled open by the retracting scars, causing incontinence or "irritable bladder." Stricture of the rectum may result. Thickenings in the fornices, in the uterine ligaments, with displacements of the uterus, are very common in daily practice and indicate the frequency of mild forms of pelvic cellulitis (Emmett).

If the process ends by suppuration, necrotic areas appear in various parts of the exudate, which become converted into pus. The whole exudate may become one abscess or several, separated by septa. Thus the entire pelvis may be riddled with abscesses. Depending on the location of the exudate and its proximity to one of the hollow organs of the pelvis, pointing will occur, and unless there is operative interference, in the course of from twenty to seventy days the abscess will break into the rectum, vagina, bladder, ureter, skin, or general peritoneal cavity. Then, if there is no other focus of suppuration, the cavity closes rapidly. If there are other foci, these may undergo the same process, and thus the patient may be ill with suppurating cavities for months and even years.

These latter cases and the immense exudates extending to the navel or kidney are very rare nowadays, but in the preantiseptic time they were common. Sometimes the abscess does not open, and nature cures by encapsulating the pus. The wall of the abscess thickens and gets firm with fibrous tissue; the more fluid part of the pus is absorbed, and such a tumor may persist in the pelvis for years, gradually shrinking in size. I watched one such case eight years, and the condition had existed for six years before. A clinically important fact is that the germs do not always lose their virulence, but may, on the occasion of traumatism, exposure, ill health, etc., break out with renewed fury and establish a general bacteremia (Martin and Busse, *loc. cit.*, p. 123). Even in the scars from exudates which supposedly had been reabsorbed tiny pus cavities containing virulent bacteria may later be found, a point of immense clinical and medicolegal importance.

*Symptoms.*—In the mildest forms, traces of which are found during a gynecologic examination as a thickening in one of the fornices, or a displaced uterus, the symptoms during the puerperium are hardly noticeable. A slight rise of temperature, a little local tenderness, and mild febrile symptoms, which are usually referred to something else or to "milk fever," may not even call the attention of the accoucheur to the pelvis at the time.

With the severer grades, however, there are marked signs of disease. The symptoms usually begin on the third or fourth day. If the fifth day has passed without symptoms, according to Olshausen, there is little danger. Still, I have seen parametritis begin on the eighth and ninth day. These cases are called *late fever*, and are sometimes due to too early getting up, which starts up anew an unnoticed parametritis, or the movements tear open some small wound in the cervix, or, after

nerves in the pelvis causes neuralgias, and even paralyzes of the muscles in the legs. If the infection takes the path along the blood-vessels to the thigh, one of the forms of phlegmasia alba dolens may result (*q. v.*).

**Diagnosis.**—At first it may not be easy to differentiate this inflammation from others in the pelvis, though the history of cervical injury, the pain and tenderness at the sides of the uterus, with absence of peritonitic symptoms and signs, will render such a suspicion well grounded. When the tumor develops, the diagnosis is usually easy and its discussion will be taken up later.

The *prognosis* is usually good. With proper treatment the patient has a mild course of fever, and absorption of the exudate takes place. Even after the formation of abscesses the prognosis as to life is good, as they either break or are incised and then heal. In the larger abscesses the prognosis is to be guarded, as they sometimes suppurate for months, the pelvis becoming riddled with sinuses, and the patient finally dying of hectic fever and exhaustion.

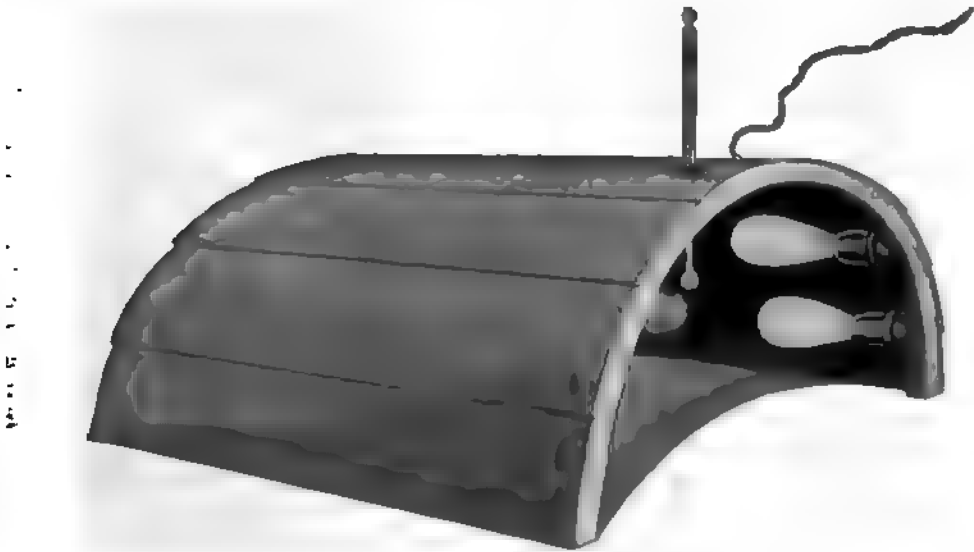


FIG. 750.—CRADLE FOR HOT-AIR TREATMENT OF CHRONIC CELLULITIS.

Made of thin sheet-iron and covered with asbestos. A bag of calcium chloride is hung inside while in use, to absorb moisture, but must not be near the bulbs (see Gellhorn).

The prognosis as to health is not so good, because only too often the women have permanent backache, leukorrhea, or disturbed pelvic circulation—dysmenorrhea—and symptoms of uterine displacements. The scars may contract and cause pressure on the nerves (neuralgias and paralysis) or on the ureters, producing hydronephrosis,—which the exudate may also do,—or traction on the bladder, and cause tenesmus and incontinence, or on the rectum, making a stricture. The uterus is sometimes drawn to different parts of the pelvis and fixed, or it is walled up in thick connective tissue and atrophies.

**Treatment of Pelvic Cellulitis.**—Besides the treatment applicable to all puerperal infected cases, attention is to be directed to the prevention of the spread of the infection and to the evacuation of pelvic abscess, or to means to hasten the absorption of large exudates. Since sitting up and getting out of bed are known to cause extension of the disease, manifested by chill, increased pain, and fever, the patient must lie quietly on her back during the acute stages. Vaginal and intra-uterine manipulations are unwise and harmful. An ice-bag, a hot-water bag, or warm, moist heat may be applied. Cathartics are sparingly used, and if enemata are required, they may not exceed six ounces in amount. Operation is contraindicated in the acute stages, even if the exudates are immense—reaching above the navel. If the symptoms—irregular fever, chills, emaciation—point to suppuration in the mass, or if fluctuation is demonstrated, the abscess is to be opened. As a rule, there need be no precipitation in this matter, experience having shown that

it is best to wait until the attack on the pus cavity has become easy and simple. If the mass points above Poupart's ligament, one may wait until the adhesion of the dome of the abscess to the abdominal wall is firm and extensive, thus making certain that the general peritoneal cavity will not be opened. By careful dissection, layer by layer, the tissues are reflected until the infiltrated wall of the abscess is reached. A small opening is made here, part of the pus evacuated, and the finger inserted. A gentle exploration is made to determine the extent of the cavity, and also whether it will be better to drain per vaginam also. If the lowest part of the abscess lies beneath the level of the cervix, the vagina may also be opened from below, guided by the finger in the pus-pocket. It is well to avoid manipulation at the sides of the uterus at the bases of the broad ligaments, because of the large vessels here, and in general to move the fingers about as little as possible to preserve the peritoneum. Tubular drainage through one or both openings is employed. Healing is remarkably quick, unless the operation was done too early, when time may be required for an undiscovered pus-pocket to break into the operative sinus. Cullen recommends to open the abdominal abscesses just above Poupart's ligament, extraperitoneally. If the abscess bulges in the posterior culdesac, it is attacked here. If the abscess bulges down one of the lateral fornices, it should be attacked behind, as near in the middle line as possible, to avoid injuring the ureter or uterine vessels *vide infra*. Since most cases of pelvic cellulitis heal by absorption, prolonged expectancy is required. When amelioration of the general symptoms indicates that the acuteness of the local process has subsided, the attendant may try to hasten the absorption of the exudates. Hot prolonged vaginal douches, repeated thrice daily, are useful, also the hot-air bath of the pelvic region, recommended by Bier and Polano. Such an apparatus is easily improvised by mounting 8 to 10 electric lights on the inside of a cradle lined with asbestos paper. Gellhorn describes the details of the treatment, which can be heartily recommended. The patient may not leave her bed until the masses have almost disappeared. General muscular tone is to be maintained by massage, but no massage is given the pelvic structures for several months after the patient is up and about. Then massage, gentle at first, watching the effect, may be used to mobilize the uterus and tubes; later, diathermia.

**Perimetritis.**—Pelvic peritonitis accompanies many forms of local puerperal infection, as parametritis, endometritis, uterine abscess, salpingitis. Since the inflammation is limited to the pelvic peritoneum, we may conclude that the infecting bacteria are of low virulence, and the staphylococcus, the gonococcus, and saprophytes are usually found. Diplostreptococci and pneumococci have been present, and the *Bacterium coli* also, either alone or in symbiosis with the others, less often the *Bacillus aerogenes capsulatus*, the pyocyaneus, and anaerobes. Streptococci of low virulence may cause a mild peritonitis. If of high virulence they quickly invade the whole peritoneum, and may be more quickly fatal than even a bacteremia. The immense surface of the peritoneum absorbs the toxins of the streptococci so rapidly that the heart and nervous system are overcome within a few days or even a few hours after inoculation.

**Causation.**—1) Traumatism, as where the uterus is much squeezed or torn, may have a mild plastic peritonitis as a sequel, and the most dangerous infections are likely to follow the introduction of even weak bacteria under such circumstances. In cases of pressure necrosis of the soft parts between the head and the bony pelvis a reactive inflammation usually prevents the spread of the inevitable infection. If a careless examiner should tear the surfaces asunder, or if alien bacteria are introduced, a rapidly fatal process may ensue. 2) Endometritis, uterine lymphangitis, pelvic peritonitis, a sequence demonstrated by Tonnelé, explain most of the cases, and sometimes the bacteria streptococci may be demonstrated on their way into the lymph-spaces through the uterus. Fig. 744; 3) a parametritis may develop from a torn cervix or vagina, and the bacteria, without meeting a reactive inflammation in the broad ligaments, may reach the peritoneum; 4) gonorrhoea may cause, in succession, by surface extension, endometritis, salpingitis, ovaritis, pelvic peritonitis, or a gonorrhoeal pus-tube may burst during or after labor; unless the streptococcus is also present, such infections are usually mild, with a strong tendency to be localized; 5) rupture of an appendiceal abscess, extension of a perityphlitis to the pelvis, or the bursting of a collection of pus anywhere near the pelvis, may cause peritonitis, limited to this region, or even spreading over the whole serous surface; 6) the bacteria may reach the peritoneum from the veins in the broad ligaments in cases of streptococcal thrombophlebitis. It is clear, therefore, that infection may spread to the pelvic peritoneal cavity in several ways—via the lymph-vessels, or

common,—by surface extension along the tubes, and via the blood, in addition to inoculation of the serous sac by direct means, the introduction of the bacteria by hand or instruments, or the rupture of infected pus-sacs.

*Pathology.*—The pathologic findings are the same as are usual in surgical peritonitis.

The peritoneum is thickened, the surface is red, the bowels displaced, adherent to each other, with deep-red patches on them where the exudate does not lie directly on them, and covered with strings of fibrinopus and serous exudate. Between the matted intestines a seropus is found in float whitish-yellow of fibrin, or the exudate may be all fibrin and

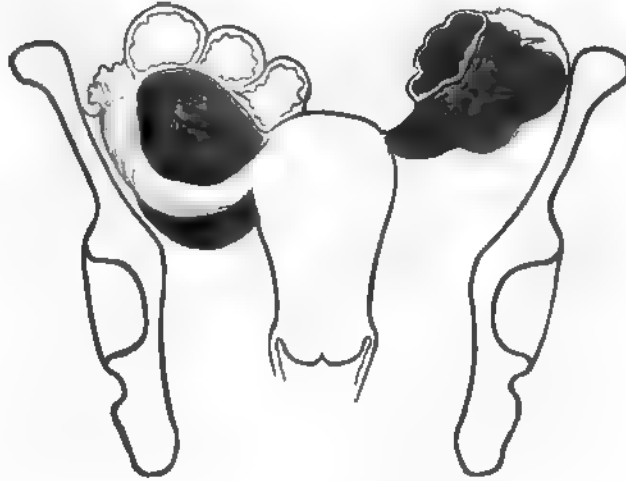
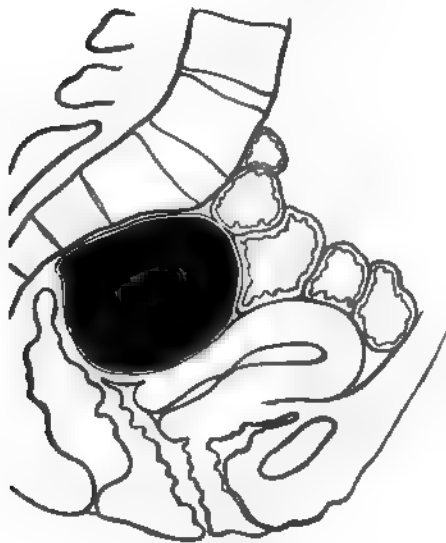


FIG. 751.—DIAGRAM TO SHOW LOCATIONS OF PERITONITIC EFFUSIONS. TUBAL AND OVARIAN ABSCESS ON LEFT. PERITUBAL EFFUSION ON RIGHT. INTESTINES FORM PART OF WALL OF ABSCESS.

streptococcic infection. The serous membrane is only reddened, with little exudate and only few shreds of

The tendency to localize is not marked. Subperitoneal cellulitis also marks streptococcic infections, and since it is impossible to drain these spaces, opening the peritoneal cavity offers little hope of cure.



—DIAGRAM TO SHOW LOCATION OF PERITONITIC EFFUSION IN DOUGLAS' CULDESAC. INTESTINES FORM PART OF WALL OF ABSCESS.

Blood may tinge the exudate, which may have an acrid, penetrating odor, stinging the hand immersed in it. If the infection is mild, the reaction of the serosa may limit its progress, which nature accomplishes by throwing out a coating of lymph which binds the viscera together. The tubal ostia are closed, the fimbriae being matted together. The exudates are thus confined in pockets bounded by adhesions, and take on the character of pus. They may break into neighboring organs,—the bladder, vagina, or rectum,—and they may creep up out of the pelvis, usually on its posterior surface, toward the diaphragm, the way being laid out by an advancing line of fresh adhesions which prevent the spread of the infection over the whole peritoneum. Great care must be exercised in palpating such cases,

as the rough pressure may rupture the adhesions, flooding the peritoneal cavity with pus, and causing death.

The usual locations for these collections of pus are in Douglas' culdesac, and

high up at each side of the uterus, in the fold between the infundibulopelvic and broad ligaments. As they form when the uterus is in the abdomen, and become adherent at the level at which they form, they do not sink with the uterus, and, therefore, are found high up. This distinguishes them from parametritic exudates which are low, nearer the vagina. The course of these exudates is the same as parametritis—resolution, absorption, suppuration, and abscess. The latter is more common than in parametritis. The former takes longer than in parametritis, and the organs are left more deformed, bound down, and matted together. Frequently the women are left gynecologic invalids, and are almost always incurably sterile from closure of the tubes.

If the infection is virulent, the streptococcus, alone or in symbiosis, being the

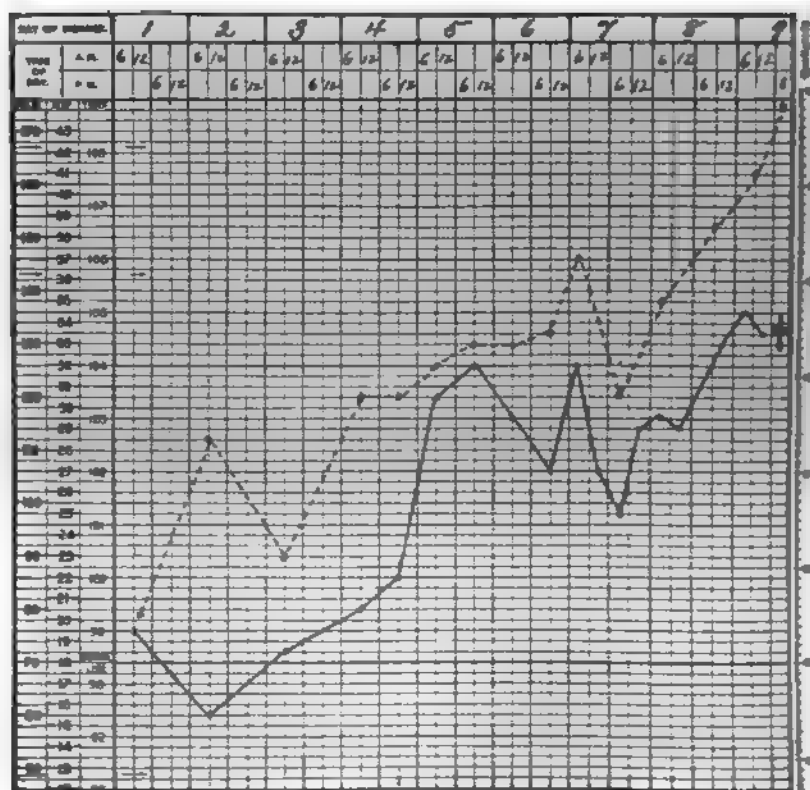


FIG. 733.—CHART OF CASE OF PERITONITIS.  
Dotted line is the pulse.

cause, its spread is very rapid, involving the whole lower abdomen within a few days or even only a few hours. Seldom is there time for the peritonitis to become universal, because the patient dies from the inundation of the system by toxins rapidly formed, and absorbed so readily from the immense area of surface of the peritoneum. The exudate in cases of general peritonitis may be small or measure several quarts in amount.

If the infection reached the peritoneum from the endometrium, it may be possible, microscopically, to trace the bacteria along the lymph-spaces. At the sides of the uterus, in the larger lymph-vessels, droplets of pus may be found in section, and the peritoneum over the uterus shows the intensest inflammatory redness, and fibrinopurulent exudate.

If the peritoneum was infected by way of the tubes, these are usually dilated

forming pus-sacs; often the ovary is involved, an ovarian abscess resulting, and early always the process is mild, being limited to the pelvis, unless improper treatment transports the infection higher up.

*Symptoms.*—Both local and general symptoms and signs depend on the mode which the infection reaches the peritoneum. The bursting of a pus-sac is almost always attended by stormy symptoms, which resemble those of ruptured ectopic pregnancy: sharp, severe pain at the site of the abscess, with tenderness, both rapidly spreading over the abdomen, collapse, followed by febrile reaction and the evidences of peritonitis mentioned below. If the peritonitis follows a rupture of the uterus, it resembles in all respects that following a severe operation. Usually the mode of entry is via the lymphatics from the endometrium, and, therefore, the symptoms and signs of endometritis precede those of peritonitis. (See Endometritis.) As soon as the peritoneum becomes involved pain becomes a prominent symptom, localized at first in the uterus and lower abdomen, spreading, in the bad cases, over the belly. Vomiting is almost a constant occurrence, preceded and accompanied by continuous nausea and sometimes by singultus. The vomit is at first watery, then bilious, and at last stercoral in character, and the action is suddenly expulsive, so that sometimes the bed may be soiled before the nurse can hand a basin. It brings no relief from the intense nausea. Constipation is the rule at first, and flatus is not passed, peristalsis being paralyzed. This paralytic ileus leads to immense abdominal distention. The decomposition of the intestinal contents (by the *Bacillus coli*, the *perfringens*, *pseudotetanus*, and others) leads to an auto-oxidation, which contributes much to the fatal ending. Later in the disease the bowels sometimes loosen, and exhausting, foul diarrheas are observed. Thirst is excessive, restlessness is distressing, but usually the mind is clear until near the end, when either delirium or coma supervenes, or—and this is most ominous—a state of *l'being*—euphoria—begins.

Examination shows the patient on her back, with the knees drawn up, both relax the muscles and to take the weight of the bed-clothes off the belly. Her expression is anxious, her color at first reddened, later pale and gray or subicteric. The face at first presents a febrile aspect, but later this is replaced by one of collapse—sunken eyes, cold, pointed nose, cool forehead bedewed with clammy sweat. In short, the typical “*facies Hippocratica*.” Owing to the constant loss of body fluids and the inability to replace them, the tongue soon becomes dry and brown, with fetor ex ore and fuliginous gums; the urine is reduced in amount and contains albumin, casts, indican, and often the bacterium causing the peritonitis. This finding shows that most fatal cases are really septicemias. The temperature rising and after the usual initial chill is raised,—often as high as 105° F.,—the pulse becomes very rapid, and, at the same time, of a peculiar snappy character, and later, when the toxins paralyze the vagus and heart muscle, uncountable or irregular. Respiration is quickened and costal, first because of the toxinemia, and, second, because of the immense tympany which anchors the diaphragm high, and, third, because of the pain in the belly. Dilatation of the veins in the splanchnic area causes symptoms of shock.

Râles are usually heard over the lower part of the lungs, and friction-sounds, if the patient lives long enough to develop a pleuritis also. The first sound of the heart early loses its booming quality, the toxins affecting the muscle. Friction may be heard over the liver, but hardly ever over the lower abdomen. Gurgling is absent (aperistalsis), but metallic tinkling may be found. The belly is tympanitic over its lower part at first, and, as the infection spreads, it may be immensely distended. The walls are usually very rigid (*defense musculaire*) and markedly tender. Deep pressure may sometimes be borne without complaint, but sudden striking of the hand causes pain. Remarkably, but true, some cases of peritonitis—and these are usually due to pure streptococcus infection—show very little tender-





and colon infections are much more favorable. All depends on the ability of the peritoneum to wall off the advancing bacteria by the layer of leukocytes, the throwing out of lymph, and matting of the pelvic viscera together. Symptoms and signs which indicate such a process justify us in giving a favorable prognosis. The pulse gives us the most reliable information of what is going on in the peritoneum; next, the general condition of the patient. Low blood-pressure is of bad omen. Slowing of the pulse is a good sign.

*Treatment of Peritonitis.*—At the beginning it may not be possible to differentiate a peritonitis from a cellulitis, and the treatment, therefore, will be the same for both. If the case starts as a violent, acute puerperal peritonitis, very little can be expected from any treatment. Simply opening the abdomen in the midline above the pubis, or posterior colpotomy, will not do much harm. If such an incision reveals a ruptured uterus or a burst pus-sac (pus-tube, appendicitis, etc.), appropriate treatment is made; otherwise several soft-rubber drainage-tubes are placed

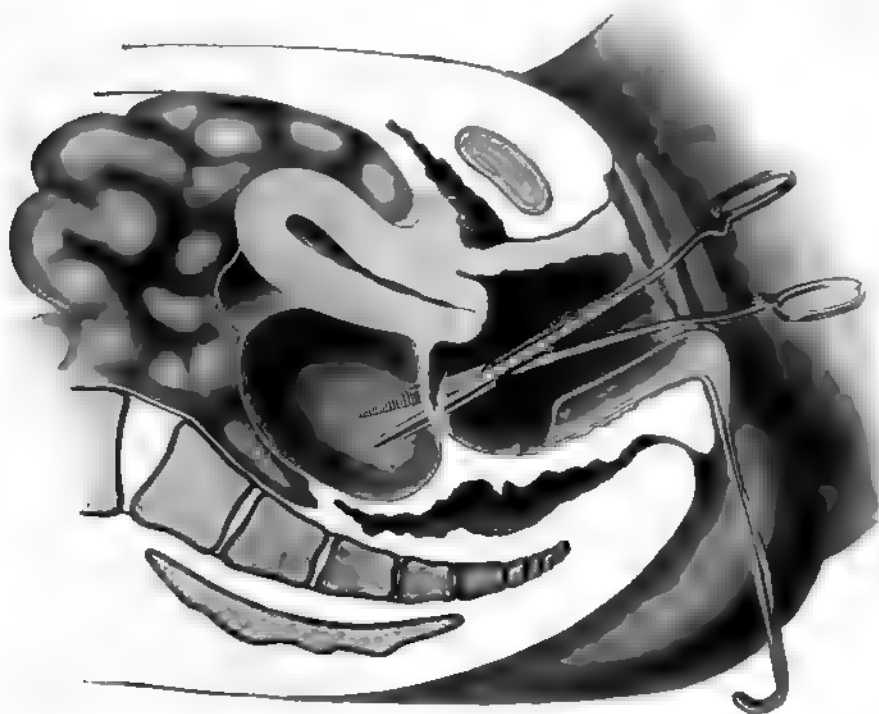


FIG. 754.—OPENING ABSCESS IN CULDESAC.

radially in the abdomen, one reaching to the culdesac, and a large moist dressing is applied. Some operators irrigate the peritoneal cavity with normal salt solution, but most men are opposed to this, as well as to eventration, because it shocks the patient too much. Lately the injection of 100 to 300 c.c. of a 1 per cent. solution of camphor in oil has been recommended. If the course of the disease is milder,—more chronic,—more may be expected of operation, and it is these cases which give the better statistics—for example, Bumm, 50 per cent.; Leopold, 23 per cent.; Jeanin, 50 per cent. mortality. The gonococcus, the staphylococcus, or a mild streptococcus are usually found here. My own experience with operation in acute diffusing puerperal peritonitis shows only one recovery in 10 women drained. When there is a tendency to localization, it is safer to wait until the abscess has formed and then drain it, usually from below.

The vagina is exposed by short, broad specula, the cervix steadied, but not pulled down with a vulsellum forceps and the posterior fornix is incised cleanly with a sharp scissors or scalpel, the tissue to be cut being held by long tissue forceps, and the opening enlarged by stretching with an 8-inch artery clamp. The sac may not be punched into—every effort must be taken to avoid increasing its tension, because a delicate adhesion in its roof may give way and pus will escape above into the general peritoneum, an accident which even the immediate laparotomy may not prevent being fatal. After the pus is evacuated one or two fingers may be passed into the cavity, and gentle palpation of the walls made, but it is unwise to try to isolate a pus-tube unless it is within easy reach, when it may be drained through the same opening. An ovarian abscess

is treated similarly. It is hazardous to remove the pus-sacs in the acute stages. It is better to relieve the danger by vaginal drainage, if necessary, and postpone the radical operation for several months until the pus has become sterile. If celiotomy is imperative, the sac may be fixed to the abdominal wall and opened three days later with the Paquelin cautery. The drainage-tube should be left in place for a day after it has ceased to drain, and the opening kept open a few days longer with a bit of gauze. Irrigations are unnecessary and harmful. The patient is kept in the Fowler position for a few days. In the very chronic pelvic sinuses vaccine therapy may be used. Vaginal douches to hasten the absorption of exudates and the hot-air bath may be used in chronic cases, but are not so successful as in parametritis. Massage may be employed in the latest stages.

**Bacteremia** is an acute infectious disease, due to the entrance into the blood of microbes, usually the *Streptococcus pyogenes*, but sometimes of other cocci and

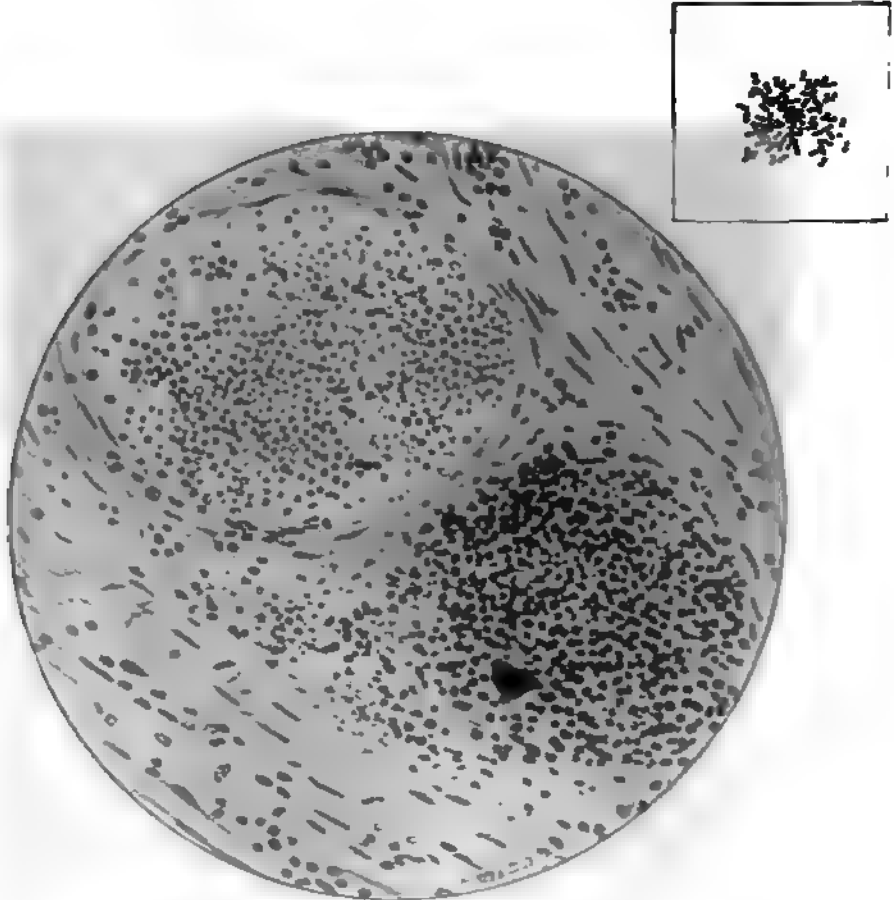


FIG. 736.—UTERINE LYMPHANGITIS.  
Above is a clump of streptococci taken from the lymphatic.

bacteria, and their toxins, which produce a dissolution of the blood, degenerative changes in the organs, and the symptoms of a rapid intoxication. The terms "septicemia" and "sepsis," from the Greek *σηψις*, meaning decay, have gained so general usage as applied to all forms of severe infection that they will probably be retained. Septicemia is synonymous with bacteremia, which term should replace it. The essential quality of these infections is the invasion of the blood-stream by the bacteria. Most often the streptococcus is causative, but the pneumococcus, the staphylococcus, the *Bacillus pyocyaneus*, the gonococcus, the *Bacillus aerogenes capsulatus*, and several anaerobes have been found. Entrance to the blood is

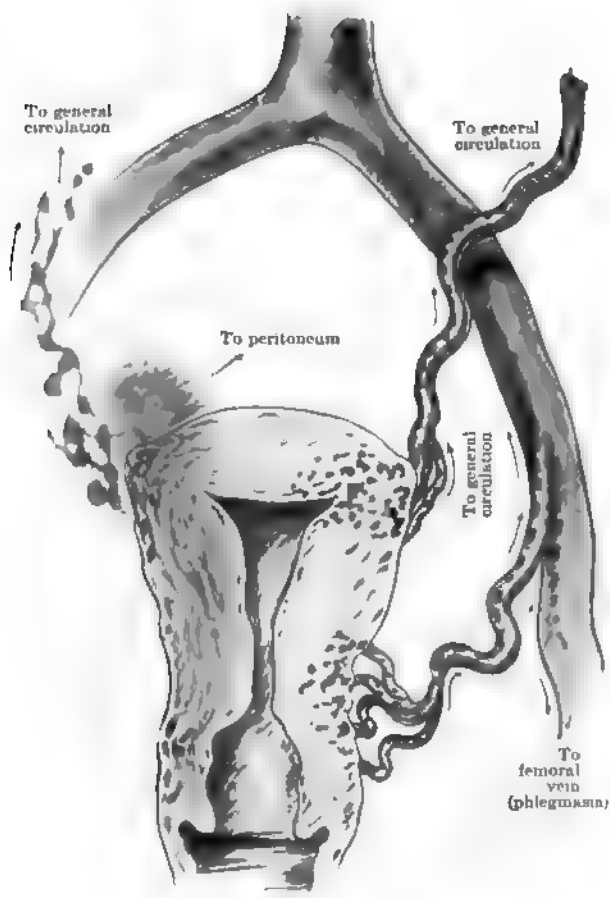


FIG. 755.—PURELY DIAGRAMMATIC. COURSE OF LYMPHATIC (RIGHT SIDE, GREEN) AND VASCULAR (LEFT SIDE, RED) BACTEREMIAS.



ined in two ways—via the lymphatics, the most usual, and via the blood-vessels, particularly the veins, and sometimes in both ways at the same time. Differing clinical pictures are produced, depending on the mode of invasion, and it is often possible to designate the symptoms appertaining to each form. Just as often the pictures are indistinct, partaking of the characters of the two affections. The lymphatic form of bacteremia usually develops from an endometritis, the bacteria passing along the lymph-spaces of the uterus and broad ligaments into the blood, or on to the surface of the peritoneum, causing peritonitis, pleuritis, etc. The septic form of bacteremia begins as a metrophlebitis, usually at the placental site, the thromboses in the veins. From these infected thrombi the bacteria get into the blood, multiply in the blood, locating in distant organs—the eye, the brain, the cord, the joints, the valves of the heart, etc.—in short, a true bacteremia develops. In such cases the local symptoms may be insignificant. A slower form of general infection occurs in the metrophlebitic cases. The thrombi suppurate—a condition not common with the streptococcus—and bits of infected fibrin or microscopic

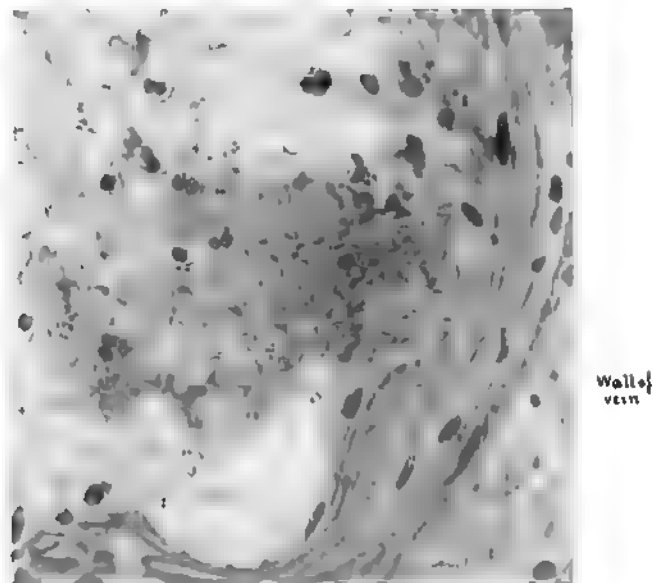


FIG. 787.—INFECTED THROMBUS FROM CASE OF TUBAL PREGNANCY.  
Methylene-blue stain

prolefs of pus, or even larger pieces of thrombus, may break off and be swirled away by the blood-stream to the lungs, the kidneys, the brain, etc., where they set up new foci of suppuration. This last disease has been named pyemia, but there is almost never any "pus in the blood." Von Herff has suggested the term "metastatic bacteremia" for this affection. Often it begins as a septicemia, developing the characters of a pyemia later.

*Pathology of Septicemia.*—A bacteremia may follow an insignificant lesion located at any part of the genital tract. Even a frenulum tear may allow the virulent streptococcus rapid access to the blood. Again, the resistance of the patient may be broken down only after a long fight or after ill-advised local treatment—that is, a process that was limited to the surface is allowed to become invasive. An example of this is the severe bacteremia which usually follows curetage in cases of streptococcal endometritis.

In the lymphatic varieties of septicemia the findings at autopsy are quite typical: (1) Endometritis gangrenosa, or metritis desiccans, often the whole tract

being covered by a grayish, sloughing, diphtheroid exudate. (2) Parametritis and lymphangitis, the lymph-vessels at the sides of the uterus being filled with purulent fluid which exudes from the cut surface; the connective tissue may be infiltrated and edematous, and this cellulitis may spread so fast and far as to justify the name Virchow gave it—erysipelas puerperalis malignum internum. The changes in the parametria may be simply a serous infectious edema, or necrosis may occur—a red phlegmon. (3) Pelvic peritonitis, then general peritonitis (Fig. 759.) (4) If the patient lasts long enough, pleuritis and pericarditis. (5) Gastritis submucosa—ga-

tritis, enteritis, and colitis. (6) General pathology of acute infectious disease—swollen spleen, fatty degeneration and cloudy swelling of muscles, and especially of the heart (tiger-heart), liver, and kidneys. Bacteria in immense numbers are found in the minute capillaries and lymphatics of these organs (Fig. 759a) (7) The findings of the metastases in the lungs, heart, brain, joints, connective tissue, and so on.

In the vascular forms of bacteremia the lymphatics are not involved at all, or to a decidedly less extent. The veins of the placental site are filled with large thrombi, which are swarming with bacteria. The bacteria erode the endothelium of the vessel; fibrin is deposited on the surfaces; the lumen is occluded, and the process advances through the venous plexuses of the broad ligament into the spermatic and iliac veins, even to the cava. From the surface of these thrombi bacteria are liberated in the blood-stream, and if they are strong enough to multiply in it, a fatal bacteremia will result. If the bacteria are less virulent or of a more pyogenic character, the process is more chronic, the thrombi undergo puriform softening, and solid bits or droplets of pus break loose, and, floated by the blood-stream, lodge in distant portions of the body, setting up new foci of suppuration. This condition has been called pyemia, and will be considered directly.

*Symptoms.*—A period of incubation of from one to three days usually precedes the outbreak of the severe symptoms. In rare cases threatening prodromes appear within a few hours after the inoculation, and the woman gets very sick and may die before thirty-six hours have passed (Fig. 758). Ordinarily, the prodromal stage is manifested by the signs and symptoms of the local process from the site of which the bacteria gained access to the blood. The

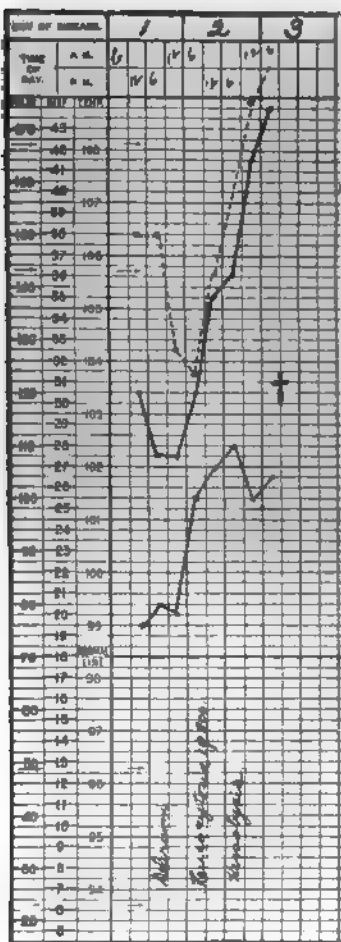


FIG. 758.—ACUTE BACTEREMIA.  
Forehead presentation. Forehead, etc. Lowest line is temperature, dotted, the pulse.

reader is referred to the chapters on Endometritis, Parametritis, etc., for these symptoms. It is often—indeed, usually—impossible to determine when and how the germs get into the blood. Schottmüller, using anaërobic methods, has been able to cultivate the streptococcus from the blood in many cases where the diagnosis of a purely local process had been made. That a serious bacteremia exists will be apparent from the following syndrome, though it must be admitted that the absorption of toxins in large amounts will produce the same conditions.

A severe chill, lasting from five to thirty minutes, ushers in the affection. During the rigor the skin is pale, the lips and fingers cyanotic. There is some resem-

blance to anaphylaxis; the temperature rises rapidly to 103° or 104° F., and the pulse jumps at once above 120, soon attaining a frequency between this and 160. At first bounding, it soon becomes soft and compressible, the toxins weakening the heart muscle. Owing to the destruction of the red blood-corpuscles the oxygen-carrying power of the blood is diminished, the patient exhibits a marked pallor, and the respirations are hurried. Tympany and peritonitis still further compromise the breathing. Very early in the attack malaise is decided—the woman appears as if stricken down, is apprehensive of a dangerous illness, even of impending death, the change being sudden and significant. Headache and sleeplessness are constantly complained of—the latter, in the absence of sufficient cause, being particularly ominous. While the mind may remain clear until near the end, this is unusual—mild delirium, delirium in somnolence, and often maniacal outbursts characterize the last days. Acute endocarditis is almost always marked by delirium.

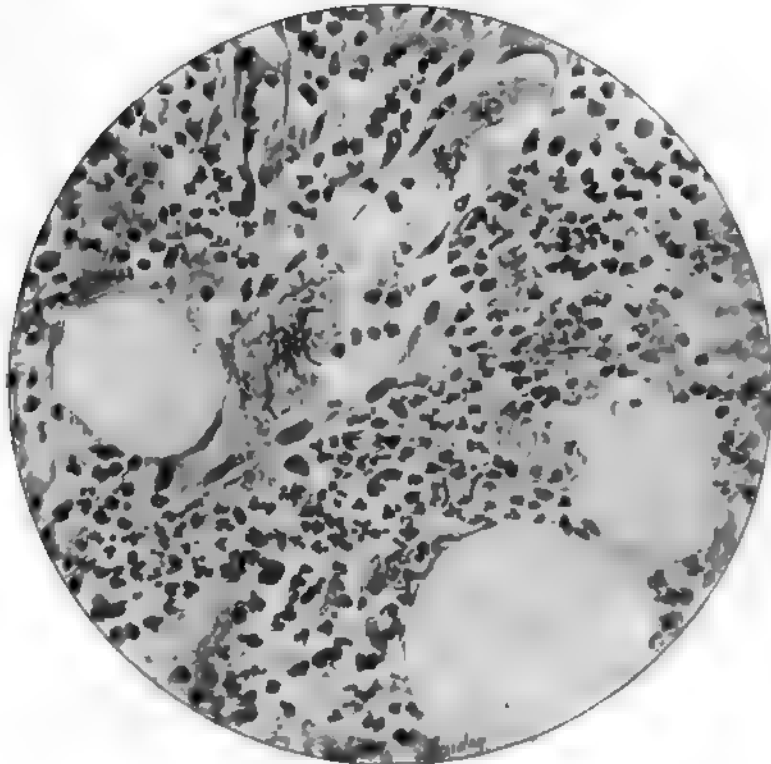


FIG. 759.—PERITONEUM INFECTED WITH STREPTOCOCCI FROM CASE OF PUERPERAL INFECTION. HEMORRHAGIC SEPTICEMIA.

Symptoms of peritonitis—nausea, vomiting, pain, etc.—very soon begin, and the facies Hippocratica shows that the fatal termination is not distant. The lochia are usually profuse and putrid, the result of a gangrenous endometritis, though sometimes the lochia are scant. The odor is not marked, being pungent to the nostril. The puerperal wounds become necrotic. Signs of peritonitis—tenderness, tympany, spreading rigidity, ileus, etc.—begin, and if the patient lives, become marked, and the picture becomes one of virulent peritonitis. While the temperature goes down, the pulse rises higher, and the tongue becomes dry and fuliginous. A peculiar fruity odor—sweet, sickening—may be noticed about the patient. After three or four days the patient feels easier, but the objective signs are worse. Her body is cold, sometimes even the trunk, and bedewed with a cold sweat; she is of a yellowish color, while the translucent parts, for example, nose and ears, are a leaden

ism, are very rare, as also are pustules and hemorrhages in the sk

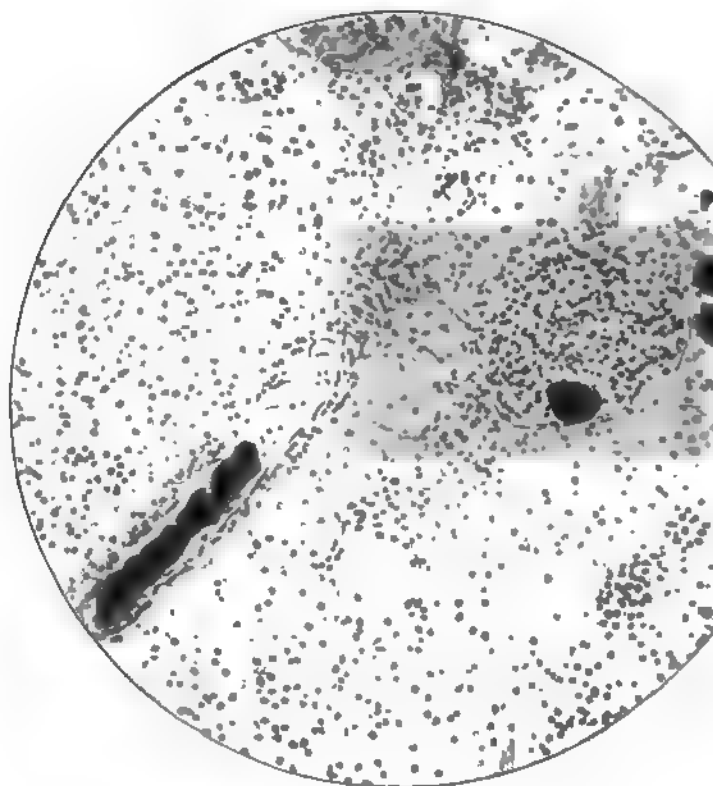


FIG. 739a.—BACTERIAL EMBOLI (BLUE) IN KIDNEY. CASE OF SEPTICEMIA

denote a very dangerous form of the malady. A marbling of t shows the course of the superficial veins is of bad omen—it indicates lysis. An erysipelatous inflammation may begin at the vulva and



ow show a raspberry color), and, indeed, the clinical picture may resemble acute pernicious anemia or leukemia.

If the patient is able to overcome the attack of the bacteria, it is evidenced by degree of mildness of the symptoms and a protracted course of the disease. The initial chill is occasionally repeated, but rarely more than once; the temperature shows greater remissions, the pulse keeps a lower level, the patient feels some improvement in her condition, sleeps more, her skin becomes covered with a warm perspiration, the peritoneal symptoms subside or do not even appear, the kidneys act more freely, the bowel movements become normal, and the disease terminates, usually rapidly, by lysis.

If embolic processes are lit up, the symptoms and signs are those peculiar to the organ and location of the new inflammations. One way that acute bacteremias terminate—and this is true of the vascular variety—is by passing over into a subacute or chronic state of pyemia. Some authors call these conditions septicopyemia. The diagnosis, prognosis, and treatment will be discussed later.

**Septic Endocarditis.**—This usually complicates the severer bacteremias, or septicopyemia, but may occur after a mild local affection, or, rarely, without demonstrable local lesions. The bacteria settle on the valves, oftenest of the left heart, causing ulceration of same. The disease is marked by the presence of miliary embolic abscesses in the brain, liver, kidneys, etc. An endocardium that is already diseased is more prone to infection, and chlorosis seems to favor it, too.

**Symptoms.**—Severe rigor, high and continuous fever, very rapid pulse, cerebral symptoms, muttering delirium, stupor, or even acute delirious mania, and, later, symptoms of meningitis; retinal hemorrhages in 80 per cent. (Litten); diarrhea; hemorrhages under the skin; scarlatiniform eruptions or blisters. The disease lasts from two to twenty-eight days, and often simulates typhoid, presenting roseola, enlarged spleen, and typhoid tongue. The heart-findings are usually equivocal. Sometimes sudden death occurs.

The *diagnosis* is not easy in the absence of a local cause for the high fever and the rapid pulse. Severe sickness, marked nervous symptoms, retinal hemorrhages, repeated chills without determinable emboli, indicate a severe bacteremia.

The *prognosis* is bad. The *treatment* is symptomatic.

**Pyemia, septicopyemia, metastatic bacteremia,** are all names for a chronic form of sepsis characterized by repeated chills, high fever with deep remissions and intermissions, and marked tendency to metastatic pus-formation. The essential pathology of this form of infection is a metrophlebitis with extension along the veins of the broad ligaments into the spermatic, the hypogastric, and the iliac veins, even to the vena cava, attended by the formation of thrombi, from which bacteria, bits of fibrin, and droplets of pus are released and carried away in the blood-stream, to find lodgment in distant organs, there setting up purulent processes. The thrombi in these infections are large, and undergo puriform degeneration, while in the acute bacteremia they are not so extensive and do not break down, but supply myriads of germs to the blood. These thrombi are found mainly in the spermatic vessels if the infection, as is usual, gained entrance at the placental site in the fundus. If the main infection is in the lower part of the uterus, or if the placental site was low (placenta prævia), the uterine veins first, and then the hypogastric and internal iliac or the femoral are involved, causing one form of phlegmasia alba dolens (Fig. 55). There is sometimes a periphlebitis around the veins in the broad ligaments, and from this a peritonitis or a parametritis may develop, which extends upward or down the thigh, the latter causing one form of phlegmasia alba dolens (*q. v.*). The uterus will show the changes resulting from the attack of the bacteria—either an endometritis or a phlebitis—and involution will be retarded. Sometimes involution is normal, the disease being located only at the placental site, which shows large and infected thrombi. The bacteria involved are again frequently strepto-

cocci of a low grade of virulence or the pyococci, but the others mentioned above may also be causative.

*Symptoms.*—Often the symptoms of a local infection, especially that of endometritis, precede the development of pyemia, and this process may have subsided and the patient already have been called convalescent when the first chill announces a new complication. Again the puerpera may have had an apparently normal puerperium, only a slight evening temperature or rise of pulse apprising the acute observer that something was brewing, when in the second week a chill and fever declare the disease. I have seen this as late as three weeks after delivery. The initial chill is constant, lasts ten to forty minutes, and is followed by high fever,—even 106° F.,—fast pulse, and defervescence is accompanied by a profuse sweat. Subnormal temperature,—95° F.,—even collapse, may ensue. Another rigor may occur within a few hours or the next day and these are repeated daily for a variable length of time. One of my cases had more than 100 chills. The severest forms of infection have the fewest number of chills, and the number of rigors cannot be foretold. It is believed that each one indicates that a bit of thrombus has broken off, or at least that the blood has gained a new supply of bacteria or toxins or more bacterial albumins. The bacteria are usually most easily found in the blood during the chill (Warnekros), but may be absent until near death, when the case may assume a more septicemic type. It is impossible to locate the embolism of every chill. The temperature is very irregular; the pulse-curve follows that of the fever, unless an embolism occurs in a vital organ (Fig. 760). Leukocytosis is the rule. The course of the disease is very chronic, lasting from three weeks to three months, or even as long as a year. At first the general condition is little affected, but sooner or later the blood suffers, the strength wanes, and a hectic condition and inanition supervene. The skin becomes waxy-gray, the pulse weak and rapid, bed-sores develop, and the patient may die of exhaustion in four to twelve weeks without metastases occurring. Metastases are the rule, however, and they may protract the course of the disease as long as eight months. The most common metastases are:

(a) *Lungs.*—Emboli here are indicated by pain in the chest, cough, bloody, sometimes purulent, expectoration, dyspnea, and the signs and symptoms of pleurisy, abscess, or pneumonia. Later, gangrene of the lung may occur. If the embolus is large, it may plug one of the larger pulmonary vessels and cause sudden death. If the embolus is exceedingly small, it may pass through the large pulmonary capillaries and lodge in the brain, kidneys, etc. If the foramen ovale is patent, the emboli may pass directly into the greater circulation.

(b) *Joints.*—When the joints are affected, the usual signs of arthritis are present. Suppuration and complete disorganization do not always follow; sometimes a serous effusion is the only finding, and it is reabsorbed, but may leave adhesions, contractures, and partial disability. The knee is most often affected, and the large joints usually, but not one is exempt.

(c) *Subcutaneous tissue* anywhere may be the seat of an abscess, which is shown by the usual signs. Fochier noticed that these abscesses seemed to have a curative effect, and he induced them artificially as a therapeutic measure.

(d) *Kidneys.*—Albuminuria is constant in the bad cases. Emboli here are shown by pain, bloody urine, and the usual course of a pyonephrosis.

(e) *Eyes.*—Two forms occur. Retinal hemorrhages, common with acute endocarditis, and panophthalmitis, with complete disintegration of the eyeball.

(f) *Thyroiditis, Parotitis.*—Metastases of the kidney, eye, and thyroid are of very evil omen, but are not absolutely fatal. Meningitis is always fatal.

If the veins of the pelvis are much involved, edema of the legs is noticed, and the abdominal wall veins enlarge for the collateral circulation. Ascites may be present. On the other hand, all three may be absent, with very extensive thrombosis. Gangrene of the flesh of the calves and posterior aspects of the thighs, leaving deep

and eroding bed-sores, occurs in very chronic cases, and the puerpera will be made a life-long or chair-ridden invalid for life.

The *diagnosis* at first may be in doubt, but soon the repeated chills, the sweats,

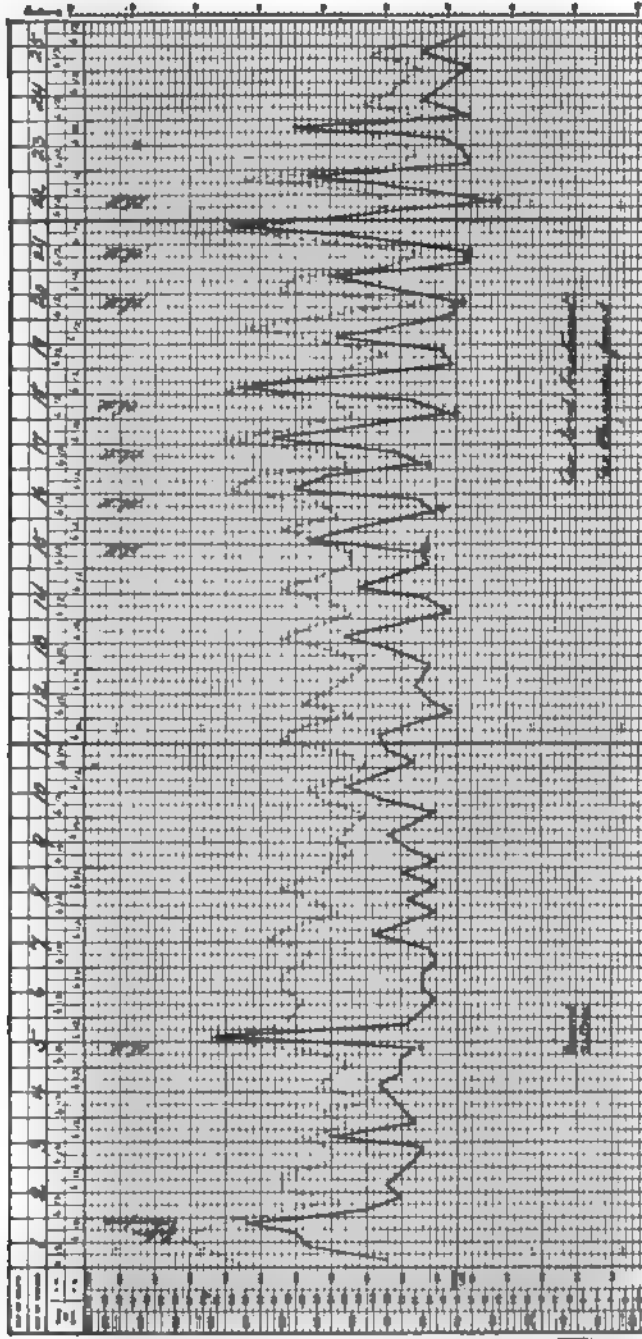


FIG. 760.—CHART OF A CASE OF PYEMIA. RECOVERY.

the zigzag temperature-chart, and the local findings will clear the situation. Vaginally, the uterus may be normal, but usually it is enlarged and slightly tender. At one or both sides the fornices may be found swollen and sensitive; indeed, the

thrombosed veins may sometimes be felt as solid, worm-shaped cords. Deep pressure at the sides of the uterus from the belly always elicits tenderness, and the same may be present under Poupart's ligaments. Prognosis and treatment will be considered later.

**Phlegmasia Alba Dolens.**—This is a term rather loosely applied to several different pathologic conditions. Literally it means a painful white inflammation, and is applied to such occurring in the legs and thighs, although equally applicable to the same condition occurring in the arms. The following forms are observed in practice:

(1) Simple thrombosis of the saphenous and femoral veins or of the iliac, with edema of the extremity beginning at the foot and extending to the trunk, but not onto it, attended by very slight fever, little pain, and, in general, very mild symptoms. The skin is cool, translucent, and mottled, or marbled with distended veins. Puncture would show a thin serum. These cases have been called mechanical thromboses, and have been explained by the stasis of the blood in the pelvic and crural veins during pregnancy and the puerperium, the long rest in the recumbent posture, the anemia, the hyperinosis of pregnancy, marasmus, etc., but the author believes that they are always due to a mild infection, and that it is a rapidly advancing endophlebitis. McLean proved that thrombosis did not occur without infection. The origin of this infection may be remote from the site of the thrombosis, and may have healed, examples of which, from my own observation, are ulcer of the ankle, mastitis, and infected perineum. At an autopsy in Vienna on a woman who died of pulmonary embolism after a simple perineorrhaphy the pelvic and femoral veins were found filled with clots, and their origin could be traced to the infected wound in the perineum. Many cases of sudden death from embolism are preceded by mild febrile symptoms, rapid pulse, or local symptoms which indicate that disease of some kind exists in the pelvis. Excepting these accidents, the course of the thrombosis is not alarming; the fever keeps a low level, the general health is good, appetite and sleep are but little disturbed, and recovery takes place in from two to six weeks. The disease usually begins after the eighth day of the puerperium, and is caused by an organism of low virulence—either an attenuated streptococcus or the staphylococcus, even sometimes by the bacteria which normally grow as saprophytes in the genitals. This form of phlegmasia occurs not seldom after myoma operations.

(2) Thrombophlebitis of the pelvic and crural veins may be the outward extension of the infected uterine veins, being only a part of a pyemic process, to which reference has already been made, and it may also occur apparently alone. In the former case the symptoms and signs of endometritis or pelvic inflammation precede the pain and swelling of the leg; in the latter case the initial chill is followed at once by the localization in the extremity. Often the intrapelvic symptoms of the early puerperium are overlooked. Usually after the eighth day, and perhaps as late as the twentieth, the puerpera experiences pain in the groin, and at the same time in the calf of the leg. The pain is so great that the leg is immovable. The swelling is noticed first in Scarpa's triangle and in the labium vulvæ of the affected side. The groin is the site of the greatest pain, and sometimes it is possible to feel the thrombosed veins under Poupart's ligament. The upper thigh is sometimes swollen to twice its natural size, has a white, opalescent, or somewhat yellowish tint, feels hot to the touch, is exceedingly sensitive, and pits with difficulty on pressure. Within a few hours or days the whole limb is involved, but sometimes the lower leg and foot seem rather to be edematous, and not infiltrated with lymph. W. A. Freund has differentiated by puncture the lymph of the upper thigh from the serum of the lower leg. The milk-white appearance of the limb gave the disease the popular appellation, "milk-leg"—indeed, the ancients believed it was, in reality, a milk metastasis.

At the beginning a chill may or may not occur, but fever is always present, together with the symptoms of severe illness—i. e., of infection, of a pyemic process.

Both limbs may be involved at once or one after the other. The fever pursues an irregular course, with marked remissions; the pulse is usually high, and the course of the disease is very protracted, especially if one limb is involved after the other. Weeks or months may elapse before the signs of inflammation and obstruction of the veins disappear, and the general health may suffer very much. Bed-sores are prone to form over the sacrum and the heels. Even long after the recovery edema of the foot will appear when the patient is much on her feet. In bad cases the inflammation passes over to the arteries; thrombosis occurs here too, and gangrene of the extremity results. If many of the veins of the leg become occluded, the circulation may be stopped, with the same result. Arterial thrombosis may also result from emboli from the valves—endocarditis. Immediate amputation is demanded when the diagnosis of gangrene is made; delay means death, and even amputation may not save. Portions of the calves and thighs may slough off from pressure and poor circulation. Treatment is based on surgical principles. (See Stein.)

Pathologically, in these cases one finds the pelvic veins full of firm thrombi, and the inflammation has crept out through the pampiniform plexus to the obturator vein, or even through the hypogastric, to the common iliac, and then backward to the femoral. In addition to the endophlebitis and phlebitis, there is a marked periphlebitis. The connective tissue around the veins is infiltrated with a gelatinous, mucoid material ("phlegma"), and the lymphatics which accompany the veins are filled and occluded by the same material. Whether or not there is a lymphangitis or simply a lymphatic stasis with coagulation of the lymph has not been settled—probably both exist. This lymphatic process accompanies the inflammation of the veins as the latter spreads out of the pelvis and down the leg. Incision into such a leg shows the cellular tissue solid with coagulated lymph—the same in the lymphatics. The large veins are filled with thrombi, partly solid, partly puriform degenerated. The phlebitis may be primary, or secondary to a pelvic cellulitis, and the process may be reversed; a phlebitis may lead to a cellulitis, and, owing to the proximity of the peritoneum, to a local peritonitis. The clinical picture may then be indistinct, combining symptoms and signs of the three conditions.

(3) *Pelvicocrural Cellulitis*.—In this form of phlegmasia the condition is one of extension of a cellulitis from the pelvis. This cellulitis differs from the form described under Parametritis in the rapidity of its spread, its tendency to attack the *subcutaneous cellular tissue*, the lateness of suppuration, if at all, and the severity of its effect on the general system. It resembles the malignant infections of the arm, and is, like them, almost always caused by a virulent strain of streptococci. The infection may leave the pelvis either above or below, and the resulting inflammation of the upper thigh will appear first over Poupart's ligament or in the nates. Swelling, pain, heat, and redness characterize this form of phlegmasia, and it often is but part of a general septicemia. Very often, in addition, thrombosis occurs in the crural veins, and then the lower part of the affected extremity swells up with edema, and the picture resembles the ordinary phlegmasia alba dolens more. It may at first be difficult to distinguish between the two forms, but the fact that the inflammation with the swelling began in the upper part of the thigh first and the edema of the foot came a considerable time later,—an observation clearly made by Levret in 1766,—and the demonstration of a pelvic cellulitis, will aid a good deal in the differentiation. Blisters and pustules occur with both forms. Necrosis and abscess are rare with the purely phlebitic phlegmasia, and commoner with the cellulitis. The course of this kind of phlegmasia is rapid and usually fatal, the inflammation involving both limbs, and the bacteremia being pronounced. If healing is to take place, the infection ceases to spread and the general symptoms ameliorate. Abscess formation is a favorable sign unless the whole limb becomes studded with areas of necrosis. Such cases are protracted and serious. The diagnosis is easy, as a rule. Sometimes it may be necessary to shut out neuritis or parametritis, when the thrombosis is deep seated and edema not yet begun.

**Treatment.—Prevention.** Extreme asepsis in the conduct of all obstetric cases will effectually prevent the vast majority of all the forms of phlegmasia alba dolens. The milder thromboses, phlegmasia of the type first described, may now and again occur with faultless technic, but these are also ascribable to infection, probably endogenous in origin, though many authors believe they are due to stasis of the blood in the veins, prolonged rest in the horizontal position, and alteration of the blood. To forestall such thromboses many authors, especially the Germans, recommend that the puerpera be gotten out of bed as soon as possible after labor—on the second or third day. This is said to improve the circulation and prevent thrombi from forming. I am not strongly in sympathy with such a practice, but give the puerpera much more freedom in bed than formerly. (See *Time of Getting Up*, p. 338.)

Aside from the general rules applicable to all forms of puerperal infection, which will be discussed later, the treatment of phlebitis and thrombosis requires special precautions. The dangers are embolism and bed-sores. Good nursing is of prime importance. Moving the patient and the affected limb is restricted to a minimum,



FIG. 761.—PHEGMASIA CRADLE.

Adhesive strap is to support the ball of the foot. The board is well padded.

and is done slowly and with the greatest care to avoid pulmonary embolism. In addition to the cradle shown in Fig. 761, a symphysiotomy bed (Fig. 815) may be employed. The limb is to be elevated slightly to aid the return circulation, which may be done as in Fig. 761, or by means of a few pillows. For a few hours each day the leg should lie flat, the change being made guardedly. The pad to protect the heel is to be placed under the tendo achillis, and the bed-clothes are to be supported by a cradle of hoops or by the top of the box shown in the illustration. Drop-foot may be prevented by an adhesive strap running from the sole of the big toe to the side of the box. The padding in the box is best made of eiderdown, and is to be frequently aired, and changed whenever soiled. After from four to five weeks of normal temperature the clot may be considered firm enough, and the patient given a little more freedom, at first tentatively, to see if fever arises—if not she may carefully get out of bed. Massage of the limb is not permitted for several months after the patient is about. I never use ointments, bandaging, or applications of wet dressings to the limb—they disturb the parts too much. At most, when there is great pain in the groin, a light ice-bag or a warm-water bag is applied. Care is required to avoid freezing and burning, both of which are more likely to occur when

the circulation is poor. Morphin may be used for pain. It is important to keep up the nourishment. Later, when the patient gets up, the foot may become edematous. A rubber stocking may sometimes be worn with comfort. In a subsequent puerperium the thrombosis may recur. In the event of pulmonary embolism the attendant is powerless. Trendelenburg and others have opened the pulmonary artery and removed the clots, but all the patients have died. One died five days later from infection of the wound, and thus, perhaps, might have been saved.

**Intramural Uterine Abscess.**—More commonly than is reported, a uterine lymphangitis or phlebitis results in an abscess within the muscular wall. Such abscesses may be single or multiple, seem to prefer the cornua as sites, and may be the only local cause for the general symptoms, or may be only a part of an extensive local infectious process, as pelvic peritonitis, cellulitis, pyosalpinx, phlebitis. These abscesses may break into neighboring organs—the bladder, the peritoneum, the parametrium, the sigmoid, or the rectum; they may break into the cavity of the uterus, giving rise to a sudden discharge of pus per vaginam, which simulates that of a pyosalpinx, or they may be absorbed or inspissated. The course of the uterine abscess is chronic. The symptoms of the acute stage of the infection subside, and the accoucheur's attention is drawn to this condition by the persistence of the fever, etc. Examination shows the uterus enlarged, and, at some point, a soft, fluctuating tumor is palpable. In my own case the abscess was felt in the right uterine cornu posteriorly, through an incision made to evacuate pus in the culdesac. The patient recovered, the abscess either draining spontaneously or having become quiescent, and she has been sterile since. A soft or suppurating fibroid will give all the symptoms and signs of uterine abscess. An exploratory laparotomy may be necessary to confirm the diagnosis. Treatment is surgical. If the symptoms persist, the abscess attacked by laparotomy, but drained if possible from below, otherwise from above, pulling off the general peritoneal cavity with gauze and by fixing the omentum to the uterus. A drainage-tube may be inserted into the abscess and led out of the belly, being fastened in place with sutures (Barrows). If the uterus is riddled with abscesses, hysterectomy and free vaginal drainage are indicated. (Lit., Pielsticker.)

**Specific Infections.**—*Gonorrhea.*—A large number—easily 15 per cent.—of the patients of our public maternities enter with a latent gonorrhea. In private practice the number will perhaps not exceed 10 per cent. Since, with modern aseptic methods, fever is becoming so rare, we conclude that the gonococcus does not play a very important rôle in puerperal infection. Acute gonorrhea is much more likely to spread than the chronic and to become serious, both as regards the mother and also the baby, its eyes, navel, etc. When the disease is latent, the surfaces are usually free from the organisms, the gonococci resting in the crypts of the vulva, the urethra, Skene's tubules, the ducts of Bartholin's glands, and sometimes the cervical glands. If the tubes are already infected, temporary or permanent sterility results. Causes which we do not understand effect an increase of virulence of these cocci; when they spread all over the surface of the parts, even to the uterine cavity, up through and out of the tubes onto the pelvic peritoneum and ovaries, causing pyosalpinx, ovarian abscess, and pelvic peritonitis. This extension on the surface is the rule with gonorrhea, but in exceptional cases the bacteria burrow into the cellular tissue, causing cellulitis, with or without abscess, or into the veins, causing phlebitis, phlegmasia, metastases, gonitis, endocarditis, even general bacteremia—gonococcemia. It is usual to find a mixed infection in these conditions, but there is no doubt but that the gonococcus alone can cause them.

**Symptoms.**—There is nothing characteristic about gonorrheal infections. Usually the fever begins later in the puerperium than the other infections, because it requires some time for the cocci to attain full virulence and to pass up through the uterus to the tubes and peritoneum. Pelvic peritonitis beginning after the seventh day is almost always gonorrheal. Involvement of a single joint,—the knee or the

## CHAPTER LXV

### DIAGNOSIS OF PUERPERAL INFECTION

Most cases of fever in child-bed are cases of child-bed fever, but this fact must not lead the accoucheur into carelessness in his treatment of feverish puerperæ. Several times I have found the attendant giving intra-uterine douches when the patient was suffering from tonsillitis. In my own experience the following diseases have been mistaken for puerperal infection: typhoid fever, acute miliary tuberculosis, meningitis, acute yellow atrophy of the liver, tonsillitis, pneumonia, la grippe, tubercular peritonitis, appendicitis, cholecystitis, ureteropyelitis, and mastitis. In practice, therefore, while puerperal infection is the first to be thought of when the puerpera sickens, the patient should be subjected to a complete and careful physical examination, and, by a process of exclusion, the diagnosis reached that the disease has taken its origin in the genitals. It is wise to repeat the general examination at intervals of three or four days to avoid surprises, and early to recognize complications.

After it is certain that the case is one of infection, these questions are to be answered, all being essential to prognosis and treatment: (1) What is the anatomic location of the infection? (2) In what direction is it spreading and how far? (3) Is the infection more general than local, or more local than general? (4) What bacterium is causative? (5) Is there anything in the uterus?

AD 1: A study of the history of the labor may indicate at once the site of the infection, for example, if the delivery was instrumental, with extensive injury to the cervix, the usual result of infection is a cervicitis followed by parametritis or peritonitis. Perineorrhaphies may suppurate. Manual removal of the placenta is often followed by endometritis and bacteremia, curetage postpartum by bacteremia via the lymphatics, with or without peritonitis, and so on. In addition to the history the site of pain and other local symptoms may point to the anatomic structure involved. Early in the puerperium it is dangerous to make an internal examination, and, further, the information gained is slight. Specular examinations are not recommended. All these manipulations tear open the puerperal wounds, reinoculate the tissues, and carry the infection to parts higher in the parturient canal. Inspection of the vulva, aided by separating the labia to get a good view of the introitus, will give useful information, the condition of the puerperal wounds being a good index of what is going on higher up. (See Endometritis.) Parametritis and pelvic peritonitis are usually easily distinguishable—if not at first, then later in their course.

AD 2: Ordinarily the spread of the infection can be traced from day to day by the clinical course of the disease. Metastases in various parts of the body give symptoms characteristic to the part affected.

AD 3: The determination whether the infection is limited to the uterus or has already invaded the blood is not easy—indeed, as was already stated, Schottmüller has proved that in many cases, formerly considered local diseases, that is, toxinemic only, a hemolytic anaërobic streptococcus may be cultivated from the blood. Formerly sterility of the blood was considered evidence that the infectious process was entirely local. Now, unless anaërobic, as well as aërobic, methods and the utmost variety of culture-media are used, sterility of the blood may not be regarded as evidence that the bacteria are restricted to the genitals. In many cases the streptococcus has been found culturally in the blood, the staphylococcus also, as well as other bacteria previously mentioned, and when they are found easily, by the or-



dinary methods or in large numbers, one may conclude that a bacteremia exists. For the technic of the bacteriologic study of the blood the reader is referred to appropriate text-books. Clinically, the accoucheur may not be able positively to decide from the symptoms whether he has a purely local infection with toxemia, or whether the blood is also being disorganized by the bacteria, but in general the severity of the illness is a fair guide. Continuous high temperature, very rapid pulse, severe prostration, etc., point to bacteremia.

AP 4: It is usually possible to determine what germ is causative—at least the one taking the leading rôle. In order to find out the causative bacteria it is necessary to make exhaustive studies of the blood, as well as of the lochia. A small quantity of the lochia is obtained from the deeper portion of the vagina by means of a simple pipet, and cultures made in all the known bacteriologic media, both anaërobic as well as aërobic (Fig. 762). Smears are also examined. The best stain is Löffler's methylene-blue. Investigation has shown that the streptococcus pyogenes is the commonest, and since some of its strains are very virulent and others less so, it is needful to discover which one is active in the particular case. Unfortunately, we are not able to do this. Tests of the virulence of cultures of strepto-

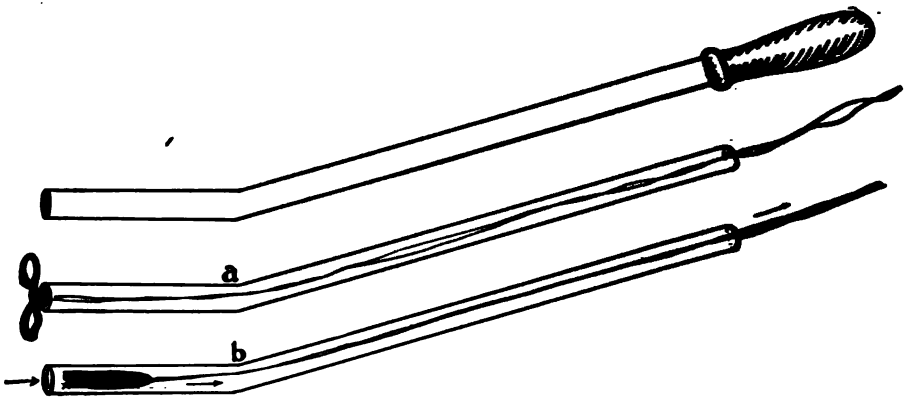


FIG. 762.—TWO FORMS OF PIPET WITH WHICH TO OBTAIN LOCHIA.

a, b, Little's pipet, a bent tube threaded with a rubber band tied at the end of the thread, which, when drawn through makes suction. The ends are closed with sealing wax.

cocci on the lower animals are unreliable because the latter do not react as do the humans. Long chains of streptococci do not indicate high virulence, but only that the culture-medium is favorable to such growth. Hemolysis in cultures (on blood-agar, for example) has been proved to occur with many kinds of streptococci, though it almost always betokens a virulent strain, and, on the other hand, anhemolytic streptococci may be very virulent (Zangemeister). Fromme's lecithin-bouillon test also has proved fallacious, and also the work of Schottmüller, Mau, and Zangemeister has borne little fruit.

Just because one identifies certain bacteria in the lochia does not permit the deduction that the infection results from that particular organism. If it is found in large numbers, in pure culture, or overshadowing all the others, the conclusion that it is causative may be hazarded, and if, in addition, the same organism is found in the blood, the diagnosis becomes assured. Regarding the streptococcus, Krönig believes that this simple test will enable one to be positive. If a small amount of lochia, inoculated on blood-agar, gives rise to very numerous hemolytic colonies, the puerpera is suffering from puerperal infection. If a finer reagent is used, such as grape-sugar bouillon, streptococci may be grown from 80 per cent. of even normal puerperæ, and the test is less valuable. Occasionally the causative organism may be recovered from the urine.

The gonococcus is easy to recognize in the lochia, and when present in large numbers or pure culture, may be held responsible for the clinical picture. Still, the accoucheur must bear in mind that the gonococcus is frequently associated with the streptococcus and the staphylococcus, and that all, or at least a goodly part of, the disease may be due to the latter. Further, gonococci may appear in the lochia of an apparently healthy puerpera, and their presence may be proved by clinical experience—i. e., gonorrheal ophthalmia neonatorum, the mother remaining well. The discovery of true tetanus bacilli has not yet been made except in tetanus. In one case seen by the writer in consultation diphtheria bacilli were obtained by a competent bacteriologist when neither the appearance of the genitals nor the clinical course suggested diphtheria. In the differential diagnosis of puerperal infections from other diseases accompanied by fever the bacteriologic investigation of the

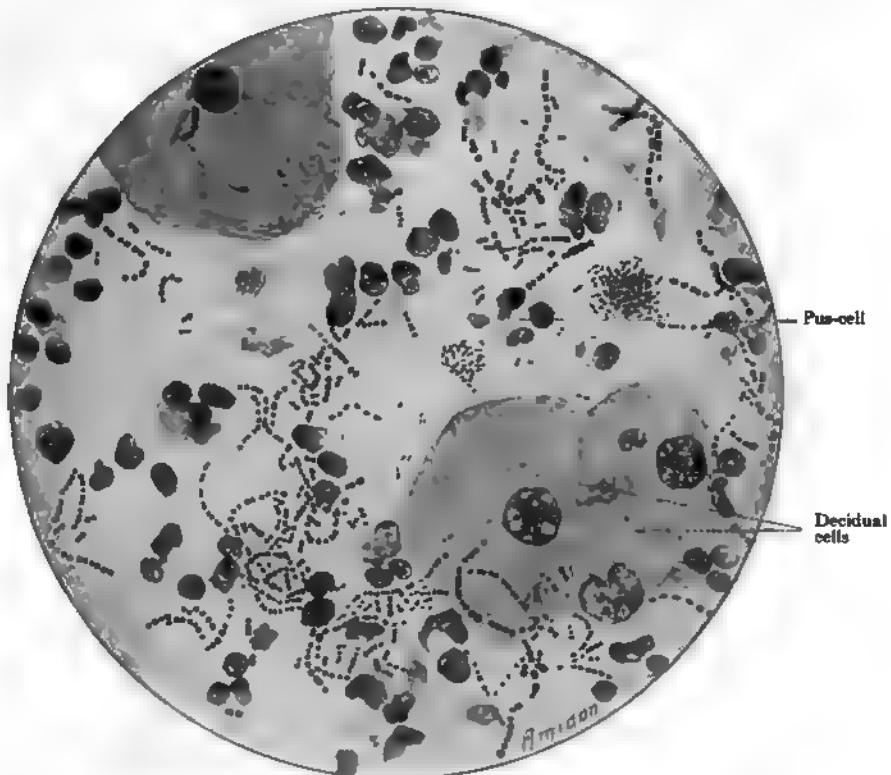


FIG. 763.—LOCHIA IN PUERPERAL SEPTICEMIA. STREPTOCOCCUS INFECTION.  
Fuchsin stain.

lochia gives only conditional information. For example, if the diagnosis lies between miliary tuberculosis and sepsis, the finding of streptococci in the lochia would not be enough to fix the diagnosis of sepsis. Much more information would be gotten from the blood examination. Here the streptococcus, the finding of the tubercle bacillus, the typhoid bacillus, and the pneumococcus give us dependable information.

Having pursued the investigation of the case along the four lines indicated, the accoucheur may usually make a satisfactory diagnosis. In actual practice other questions arise. One of the most common is—(5) "Is there anything in the uterus?" This has been discussed on p. 843. If the answer cannot be positively made, the case is treated as if there were nothing in the uterus—contrary to older teachings. Another duty of the attendant is the diagnosis of the condition of the vital organs of

It of anger against her husband who drank up their small store of money, and pity for her children, who were without food, became intensely wrought up and developed a temperature of 105° F. The nurse brought food for her and her children, and the fever subsided within six hours. No other cause was demonstrable. Noting this possibility, it must, however, be emphasized that pyrexia from nervousness is of greatest rarity. Chill and fever after emptying the bladder (catheterism) occasionally may be noted. Infection is almost always the actual cause.

**Prognosis of Puerperal Infection.**—Statistics, usually deceptive, are particularly misleading in puerperal infection. The disease is so protean in its manifestations that it is next to impossible to group cases similar enough to make general deductions from—to say nothing of reducing them to figures. Experience, however, will permit the attendant to give a good or a bad prognosis, and if he has made a complete diagnosis, as outlined in the previous section, much difficulty will be overcome.

Infection varies in gravity with the anatomic part involved, the direction of its

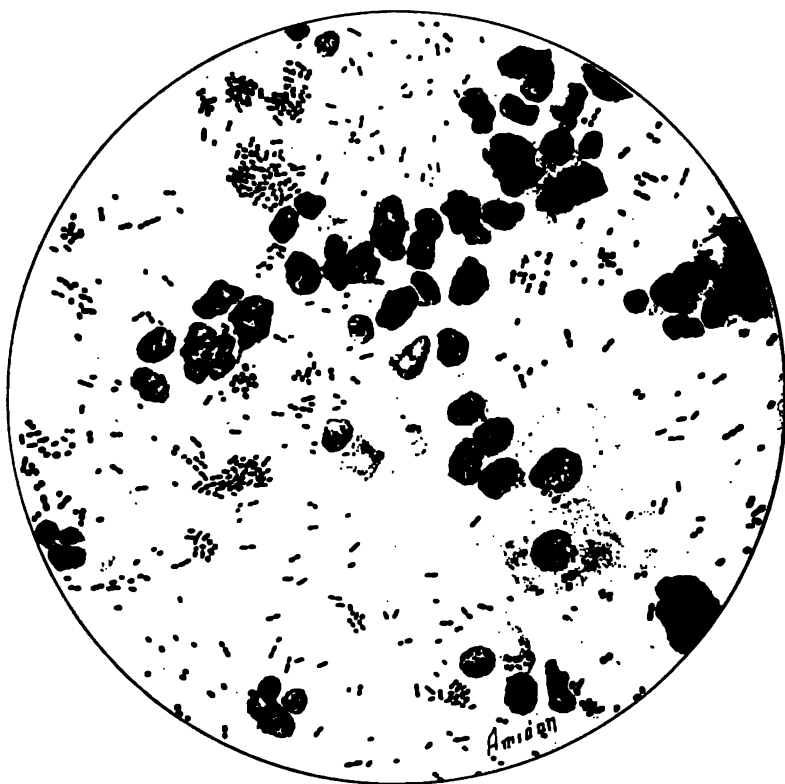


FIG. 765.—LOCHIA—GONORRHEAL INFECTION.

head, the degree of invasion of the blood, and the nature of the infecting organism. Cervicitis and vaginitis are usually not serious—only rarely does the infection break through the natural barriers and get into the blood or travel up to the peritoneum, and this, with the *Streptococcus pyogenes*. Endometritis is more dangerous, but here, too, the large majority of cases recover, although the streptococcus may be causative, unless improper treatment is instituted. Putrid endometritis, even when there is considerable decaying material, heals rapidly if drainage is good. Leucometra, responsible for many "one-day fevers," is easily relieved by treatment and almost invariably has a good prognosis. Parametritis, with the exception of the form called erysipelas internum puerperale, which is really but a part of a

pt 38° C., or 100° F., as the normal limit. In my own practice every temperature above 99.° taken with a certificated thermometer, in the mouth, is regarded as morbid; indeed, any rise above 99° F. is viewed with suspicion, and the rise which so often follows labor is also ascribed to an infection and is not held to be a "fibrin ferment fever." In my opinion this postpartum fever is due to the inoculation of the puerperal wounds with the bacteria ever present in the parturient canal.

From my own experience in private practice, in practice in the maternity wards of general hospitals, in a special maternity hospital, and in consultation; from my knowledge of the results of my colleagues who treat cases parallel to mine in the same institutions, and from my observations of the work done in maternities at home and abroad; from my studies of the statistical tables of several countries and of a large number of institutions, details of which it is naturally impossible to present here, I have come to the following conclusions: Puerperal infection is still very prevalent—indeed, it is perpetually endemic; it kills 1 in 400 women delivered of full-term children; it leaves as incurable invalids at least ten times this number; it is more frequent in private practice than in maternity practice; it is more frequent in maternities that form an integral part of a general hospital than it is in private practice; it is least frequent in the special maternity hospital even when the latter accepts infected cases (the danger of infection is so well recognized that transmission of the disease to others is prevented); it is more frequent in maternities used for the teaching of students than in those not so used, or where only midwives or nurses are taught; it is more frequent in January, February, and March, the time when the general health of the people is below par, when fresh air and sunshine are at the minimum; it is more frequent during the prevalence of la grippe, colds in the head, pneumonia, scarlet fever, erysipelas, bacteremia from other causes (a fact proved by Galabin for England and Wales); it is more common among the delicately bred well-to-do than among the poor, who, through ages of squalor and filth, have developed immunities, which the other, in their protected lives, do not possess. Medical practice which are without bad result among the poor would, if applied to the finely bred woman, produce effects horrible to contemplate; it is more frequent in the country than in the city, perhaps because so many births occur in the maternities; it is still carried about on the person of the accoucheur as a rhinitis or pharyngitis, for example, and, in those times when it seems that an epidemic influence is at work, the cause may be sought in the inefficiency of the means ordinarily practised for prevention in the presence of numerous alien bacteria. For example, a certain practitioner, fair, careful and thorough in his aseptic technic, may for years have no infections. Suddenly, when there is a prevalence of streptococcal infections, rhinitis, sinusitis, mastoids, etc., he has a succession of septic cases. This means that his ordinary methods of prevention are not efficient enough in the presence of extra danger.

It is impossible to learn the number of deaths that occur long after parturition, but indirectly from its action, from operations done to relieve the effects of puerperal infection, or from diseases of the heart, lungs, liver, and kidneys, which took its origin in a puerperal process. Counting such deaths would swell the mortality figures decidedly. Likewise it is impossible to measure the invalidism suffered by these unfortunate women.

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*Boxall*: Puerperal Morbidity, 1903. Sherratt and Hughes, London.—*Heynemann*: "Phagocytosis in the Lochia." *Arch. f. Gyn.*, 1911, vol. xciii, H. 1.—*Lea*: Puerperal Infection, Oxford Medical Publications, 1910.—*Roussy*: *Jour. Obst. and Gyn., Brit. Empire*, October, 1911, p. 165.—*Sinclair, Sir W. J.*: *The Life of Semmelweis*.

In the hope of accomplishing these purposes the following methods are practiced:

(1) Intra-uterine douches of normal salt solution or of antiseptic solutions, such as bichlorid of mercury, lysol, carbolic acid, alcohol, iodine, etc., if the attendant believes that such remedies have real bactericidal action on germs already inside the living tissues. Harvey knew about douches, but Ruleau, in 1704, first used them for fetid lochia. They enjoyed the greatest vogue in the years 1881 to 1900, when being given in normal puerperæ as a routine, but lately have lost, in large part, the confidence of the accoucheurs. The objections to the uterine douche are (a) It is inefficient, the bacteria being beyond reach within fifteen minutes after they are inoculated; (b) it is painful, sometimes violent uterine action being set up, and if (c), as sometimes happens, part of the liquid escapes through the tubes into the peritoneal cavity, syncope, vomiting, and peritonitis may result; (d) the nervous shock sometimes causes syncope, even convulsions and coma (Bar); (e) the antiseptic employed may be directly poisonous, over 50 cases of bichlorid and many more from carbolic-acid poisoning being on record, the chemical being absorbed by the uterus, or gaining entrance to the blood through the sinuses, (I know of many which have not been recorded); (f) air-embolism; (g) perforation of the uterus; (h) profuse hemorrhage; (i) chill and fever—the infection having been reinoculated by the douche; (j) sudden death, which is usually from air-embolism, but may be due to cardiac paralysis; (k) the infection may be carried up higher in the parient canal, heretofore unaffected.

Continuous irrigation of the uterus was recommended in 1877 by Schücking. It had some vogue, and until very recently was occasionally practised. A few cases have been treated with the Carrel-Dakin method, continual disinfection with pchlorite solution. It is too early to pass judgment.

(2) Swabbing out the uterus with gauze wound around a long dressing forceps, with or without antiseptic or caustic solutions. Alcohol, carbolic acid, iodine, and combinations of these have been used.

(3) Brushing the surface of the endometrium with a round brush, similar to those which are used for cleansing bottles (*ecouvillonnage*). Introduced by Doléris, it was quite popular with French accoucheurs, and is recommended by Lea as safe and efficient. The Germans do not use the brush, nor do American obstetricians. They regard it as dangerous, but perhaps not so much so as the curet.

(4) *Curage*, or digital removal of the contents of the uterus, is recommended by a large number of authorities here and abroad, among whom a few may be mentioned: Whittridge Williams, Hirst, Galabin, Jellett, Sinclair, Bumm, Chrobak, Alfred, Schauta, Bar, Pinard; and Pestalozza. Some recommend aseptic or antiseptic douches before and after operation, or packing the uterus with sterile or antiseptic gauze.

(5) *Curetage*.—This operation, introduced in 1850 by Recamier, who invented the curet for the purpose, has obtained a very generalized employment. Some operators use a blunt, others the sharp, curet; some use the instrument as a routine practice as soon as febrile symptoms appear; others use it only if the finger fails to move firmly adherent masses; some repeat the operation once or oftener; some pack the uterus with antiseptic gauze at the completion of the operation; others do this only in the event of severe hemorrhage, etc. The operation has always had opponents, prominently among the earliest of whom may be mentioned Karl Schröder, and lately many authorities are arrayed against the practice—Whittridge Williams, Noble, Cragin, Edgar, Watkins, Ries, Bumm, Leopold, Fehling, Krönig, Wit, Olshausen, and others, some of whom formerly advised the procedure. The dangers of curetage—and these are present with both blunt and sharp instruments—and with curage with the finger are: (a) The delicate bank of leukocytes, the wall of the uterus throws up to limit the spread of the bacteria, is broken through at innumer-

able places, and the bacteria literally ground into the lymph-spaces and the blood-lumina—it is a thorough vaccination or inoculation of the uterine tissue, which resembles raking the soil after strewing it with seed; (b) curetage, no matter how expertly done, cannot remove all the diseased tissues. The bacteria, within a few minutes after inoculation, are already out of its reach, and, further, at autopsies in cases where the curet had been used invariably parts of the endometrium could be proved never to have been touched by the instrument; indeed, even the placenta has been found; (c) perforation of the uterus is a common occurrence, almost always fatal from peritonitis; even the greatest gentleness may not prevent such an accident, because in some cases the muscle is as soft as butter; (d) hemorrhage from the reopened placental sinuses, even air-embolism, has been reported; (e) the freshly united wounds are torn open and new ones created, into all of which infection is ground; (f) a pyosalpinx or other pus-sac may be ruptured by the manipulations. It seems about as reasonable to curet the nose and throat in a case of diphtheria as to curet the uterus for sepsis.

(6) Emptying the uterus with polypus forceps is a very dangerous procedure, because parts of the uterine muscle, even the intestine and omentum, have been pulled out under the impression that ovarian remnants were being removed. Polypus forceps may be used only to remove pieces floating freely in the uterine cavity.

(7) Drainage of the uterus with rubber or glass tubes is the practice of the French, Italian, and American accoucheurs.

(8) Packing the uterus with gauze, or draining it with the same, is commonly employed to stop hemorrhage after the operations just considered, and is also employed by some as directly antiseptic measures. The technic of these operations does not differ from those performed in the treatment of abortion, to which the reader is referred for details.

For the last ten years I have practically dispensed with local treatment of puerperal infection, being convinced that it does much more harm than good. Only if the woman is having uterine hemorrhages do I interfere, and then, by packing the uterus with 2 per cent. iodoform gauze to stop the flow and aid the escape of the retained masses causing it. This packing is repeated, if needed, during several days. Often the foreign matter comes away when the gauze is removed, and usually the temperature comes down, the patient's general condition improving. Only after the local barriers are considered strong enough and involution of the uterus well advanced is the removal of the retained material attempted. This is only after the temperature has been normal two or more weeks. One waits as long as possible. Nature often does wonders. Most authorities do not take this position. Bumm, Williams, Hirst, the French, and many advise a primary curet of the uterine cavity with the finger and the immediate removal of its contents, but they all emphasize the danger of the procedure when the infection is streptococcal, urging that it then be omitted. It has already been proved that it is possible to say—certainly, at the first examination—whether a given infection is streptococcal, not, streptococcal, and, further, before the streptococcus can be demonstrated, infection is through the uterine wall and beyond. On the other hand, if the infection is saprophytic, but little danger need be apprehended from it, and it is only a wait a few days to see what course the disease will take. Winter, of Königsberg; Mermann (*loc. cit.*), Saft, and Baumm, Höhne, Barsony, Traugott, Thorne, of Cleveland, Watkins and Ries, of Chicago, Davis, Cragin, and Polak, of New York, are opposed to local treatment, and Credé, of Leipsic, shortly before his death strongly emphasized its dangers, advising its total discontinuance. It is gratifying to note that one voice after another is being raised against douches, curetage, and other local interferences with the processes of healing adopted by nature. The author hopes that the curet will soon be recognized as a criminal instrument in the treatment of simple puerperal infection, and that the other operations will be reduced to

indication—to stop hemorrhage. (For the treatment of pus collections see Pelvic Peritonitis.)

**General Treatment.**—Everything that will improve the woman's general health will help her throw off the disease, and the attendant should count no effort lost that will increase her resisting powers. Fresh air is important, and I have employed the outdoor treatment with good results, though not so good as expected. Sleep is a prime necessity, and if procuring mental and physical quiet do not bring it, morphin may be used. Morphin is also given for pain. Pain is depressing and fatiguing. In a maternity the sick woman should be isolated—first, because of the danger, recognized by practically all authorities, of her being the beginning of an epidemic of puerperal infection, and, second, to insure her quiet. Visitors are excluded, and every one about the house should bear a cheerful mien. Nursing the child is stopped, first, because the mother needs all her reserve force to combat the infection; second, the acts of nursing are disturbing and tiring, and, third, the child may be infected. In those cases where, contrary to orders, nursing has been continued, the child does not always suffer from the poor quality of the milk, though it often does.

For the fever, as a rule, nothing need be done. If continuously high, cool sponging, cool packs, or the cool bath may be used—rarely the bath, because it involves too much exertion for the patient, and a weak heart may go default; further, in parametritis and perimetritis the patient may not be moved much. Antipyretics are contraindicated. Medicines are very sparingly used. Of tonics, quinin is the best, in two- or three-grain doses. Hexamethylenamin is given if there are signs or fears that the urinary tract may be involved in the infection. Drugging is avoided, so far as possible, first, because it does little good, and, second, because it spoils the stomach, the most important ally of defense. Alcohol, formerly considered almost specific in all kinds of infections, has lost favor. At most the system can utilize  $\frac{1}{2}$  ounce a day, and there is no objection to giving this amount in the form of eggnog or a wine to stimulate a flagging appetite.

**The Bowels.**—In prolonged cases an occasional laxative is ordered, and, as was said, a brisk cathartic forms part of the routine treatment at the beginning of the disease. Diarrhea may be one of nature's methods of ridding the system of toxins, and is not interfered with unless pronounced, and when it begins to exhaust the patient. When the diarrhea is too marked, charcoal and salol may be tried, but *magnesia usta*, in dram doses every three hours, may do better. Opium and starch enemata may be necessary. Vomiting is always a bad symptom, and if bilious, almost always means a fatal ending. Food by the mouth is withheld for a while and rectal feeding instituted—saline solution with 3 drams of grape-sugar added to each quart, by the drop method. If the vomiting persists, the stomach may be washed out. It is surprising how much greenish-black fluid is removed, and the patient usually feels much relief for several hours. Later, against peritonitic vomiting, we stand powerless and dismayed. When food cannot be administered by the stomach and the rectum proves too irritable, it has been recommended to sew the intestine to a tiny opening in the upper linea alba and inject predigested foods through the fistula into the bowel. Success rarely follows such operations, because the women do not die from starvation, but from toxinemia.

**Meteorism** in peritonitis is a troublesome condition. Overfeeding and cathartics are to be avoided and enemata given. Milk and molasses, of each  $\mathfrak{v}$ ijj, form a very efficient enema in causing flatus to pass, chamomile tea enemata being good also. Physostigmin salicylate,  $\frac{1}{16}$  grain, may be given every four hours for four doses, but in my experience it has failed to relieve the distention. Pituitrin may be tried (except after cesarean section). The rectal tube gives some relief. If the stomach is dilated, the patient is to lie on the abdomen and the foot of the bed is raised, or the stomach is washed out—a sovereign remedy which may be repeated

every four hours. In the rarest cases the bowel may be punctured and the gas removed through a fine needle, a procedure I have never had occasion to practise. The small intestine may be opened through a tiny incision near the navel and drained. In one case it seemed to me that the electric vibrator, allowed to play on the belly, stimulated peristalsis.

For the *chills*, the patient is covered warmly and given a hot drink. If the chill is prolonged,  $\frac{1}{4}$  grain morphin is given hypodermically.

Attention is given the heart, and all exertion of the patient is forbidden in order to spare its strength. Cardiac stimulants are withheld until absolutely needed. My experience with digitalis, etc., and strychnin has been disappointing. For the syncopal attacks common in severe bacteremias an abundance of fresh air and pure oxygen are useful. Deep breathing occasionally and change of position, to prevent pulmonary stasis.

Special attention is directed to the *diet*, and an abundance of sugar and proteins is provided—less of fat. Milk, buttermilk, matzoon, kumiss, eggs, jellies, cereals, sugar, ice-cream, and gelatin in all forms are permissible.

Finally, the *mental state* of the patient should be treated. She should be buoyed up with the hope and assurance that she will recover—indeed, speaking from experience, I can say that even the apparently hopeless cases sometimes get well, and I am convinced that the mind of the patient has considerable to do with her struggle with the infection.

**Specific Treatment.**—Since the bacteria are beyond the reach of the antiseptic douche and the curet, we try to get at them and to neutralize or remove their poisons by way of the blood. We try to do this in two ways—first, by direct antiseptic or bactericidal action; second, by stimulating the antibacterial and antitoxic power of the blood, as well as we know these forces.

Some of the remedies to be mentioned partake of both these qualities. In the first class may be listed iron, mercury, quinin, alcohol, iodin, silver, and a host of others. Mercury in the form of inunctions was recommended by Fehling thirty years ago, and as intravenous injection, by Kemsarsky, in 1894. Barsony. One-fourth grain of bichlorid dissolved in three ounces of water is given in the median basilic vein daily. Nephritis is a contraindication. My associate, Dr. Stowe, at my suggestion, employed it in 34 cases, but without decided benefit, though with no resulting harm. It increases leukocytosis and raises the opsonic index. Polizzotti, and perhaps combines with some of the toxins. Salvarsan has been used with reputed success. Silver, in the form of a colloidal salt—collargol—was introduced by Crocid in 1895. As an ointment, unguentum Crocid, I have used it freely without observing the least effect. Given per rectum it has also failed. Given intravenously, 10 c.c. of a 1 to 2 per cent. solution daily, it produced an effect, but this not always good. I have given in all 20 injections. In one case I felt that the patient was benefited, and I considered the remedy harmless until one woman nearly died in collapse immediately following the injection, after which the temperature went to 106° F. She was sick with pyemia for two months, but ultimately recovered. It is certain that the injections cause leukocytosis, which may have had something to do with the reported cures. In doses which it is safe to put into the blood it has no bactericidal action. Drossen, van de Velde, Robins, Treub, Bonnare, Barson, Albrecht, have reported some good results, but by no means invariable improvement. Kraus, von Rosthorn, Chrobak, Fehling, Hartman, Polak, Jones, and others report more failures than successes. As Husy of Basel points out, it may be dangerous to kill the bacteria in the blood because their toxins are thus set free. A remedy that will reduce the virulence of the bacteria and their growth would be more rational. Husy recommends methylene-blue, silver, which is introduced by Erdman and Müller.

**Salt Solution.**—This is a remedy which has been much lauded in the last few years in the treatment of all forms of infection, and, in fact, it is very valuable, but it is not a panacea. The best method of administration is by slow infusion in the rectum—the drip method. The solution is kept hot in a vacuum bottle hung near the bed, and the flow is so regulated by an artery forceps clamping the tube, leading into the rectum that from 20 to 40 cc. flow in each minute. If the patient becomes unconscious, the injection may be made intermittently, or the hypodermic or intravenous route employed, but either is much more distressing to the patient, and a type of the danger of overloading the circulatory system, causing renal congestions.



**monum.** The action of the salt solution is unknown. It probably does not wash the toxins from the blood, because these are usually so bound onto the cells that only biochemic action can loosen them. Leukocytosis is stimulated, but probably the good effects of the salt solution lie in the stimulation of the heart, kidneys, skin, and intestine, keeping up the tonus of the vessels, in relieving thirst and fatigue—thus improving the general resistance of the patient. The stimulation of the pelvic circulation should also be thought of.

**Transfusion.**—As an aid to the antitoxic forces of the septic puerpera and to sustain her, blood may be transfused from the husband or other healthy donor. It may be defibrinated or the serum alone injected. I have used it on several occasions, but cannot draw conclusions as yet. It has been recommended to immunize the husband to the puerpera's bacteria by vaccination, and then transfuse his blood.

**Serum Treatment.**—After twenty-one years of trial with sera of all kinds we must decide that antistreptococcic serum does not cure puerperal streptococcic infection. The only action such a serum could have is phagocytogenic, and this Weaver and Tunnicliff believe it does possess, and recommend its use, although Williams, Pryor, and Fry reported adversely in 1899. I usually give 200 c.c. of the serum as soon as the diagnosis of severe streptococcus sepsis is made—early in the disease—and seldom repeat the dose. Erythema at the site of injection, general urticaria, swelling of the joints simulating pyemic joints, and moderate, temporary increase of fever, may be observed,—rarely serious symptoms. It is useless in pyemia, thrombophlebitis, cellulitis, and peritonitis. In early cases of acute streptococcic bacteremia, especially if complicated by erysipelas, one may hope for some effect, but, to repeat, the result is often disappointing. As a prophylactic the antistreptococcic serum is useless, but the tetanus serum useful.

**Vaccine Therapy.**—Up to the present the clinical results of the vaccine treatment of acute puerperal infections have been negative, a conclusion reached by a committee composed of Williams, Cragin, and Newel in 1910. Polak, however, recommends a mixed stock vaccine in doses large enough materially to increase leukocytosis.

This is with the hypodermic use of the vaccine. Recently we are attaining a measure of success in acute infections, typhoid, pneumonia, acute articular rheumatism, etc., by intravenous injection of vaccines. Much study has been made of this subject, and it seems that the effects are due to the introduction of an alien protein and that it matters little which you use. The reaction, chill, fever, leukocytosis, occurs in all cases, whether typhoid vaccine or proteose be used, and therefore the curative effects are probably pharmacologic more than from specific immunity action. The specificity of vaccine treatment having come into question we may have to revise our notions of immunity reactions. The subject is still in the early experimental stages, and not ready for presentment in a text-book. (See J. L. Miller (Lit.), Teague, and McWilliams.)

**The Abscess of Fixation.**—It has been known for a long time that if a case of sepsis has a focus of free suppuration, recovery is very probable, and Fochier, in 1892, advised the injection of turpentine into the thigh, with the object of making an abscess and thus inducing leukocytosis. Voiturier, in 1909, reported 120 cases and reviewed the literature. The results have not gained any general recognition for the procedure.

**Surgical Treatment.**—Reference has already been made to the treatment of pelvic inflammations by operation, and no real difference of opinion exists regarding the procedures advocated for the treatment of localized suppurations. Two radical operations, however, have been employed in the treatment of severe infections, about which there is still much to be learned. One is extirpation of the uterus, the other, ligation of the pelvic veins, with a view to stopping the progress of a thrombophlebitis.

**Hysterectomy.**—Schultze removed a uterus containing an infected placenta in 1886, and the patient recovered, and since then the operation—total hysterectomy—has been done several hundred times, but with not enough success to give it a firm place in our therapy. At the Congress in Rome in 1902 the subject was one of

the main themes, and again in Madrid in 1903. Fehling reported in Rome a fatality of 55.7 per cent., and Cortiguera, in Madrid, 51.8 per cent.; Doléria, 9 cent.; Mouchotte (all abortion cases), 43.3 per cent. The main difficulty is placing the indication. It is generally admitted that in the following conditions in all of which the local lesion is the predominant factor—hysterectomy is justifiable: (1) Rupture of the uterus or vagina with infection, perforation of the uterus with beginning peritonitis, or perforation of the uterus during the local treatment of an infection within it; (2) infection of a fibroid, or when a fibroid has been bruised by an operative delivery and infection is feared (a fibroid polypus is removable from below); (3) cancer of the uterus; (4) infection, with a pregnancy; (5) abnormal adherence of the placenta and infection; (6) incarceration of all or of a part of the ovum, for example, missed abortion or labor with infarction (in the latter three instances the difficulty of removal of the masses in the manner must be also considered); (7) uterine abscess; (8) gangrene of the uterus.

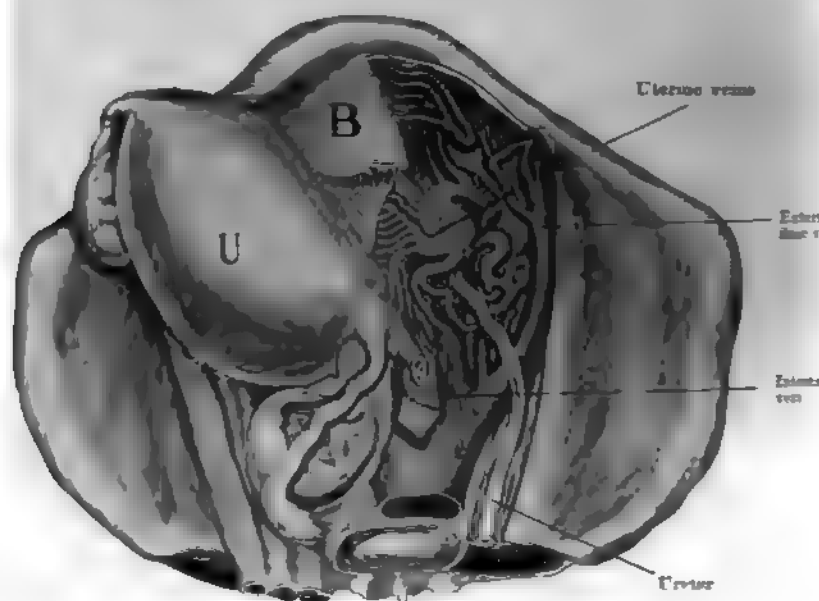


FIG. 766.—VEINS OF THE RIGHT PELVIS (from Kownatski).  
From a woman who died of eclampsia four days postpartum.

It has also been suggested to remove the uterus in cases of peritonitis, extensive involvement of the tubes and ovaries, and in uterine emphysema (Demelin). The shock of such operations is very badly borne by these intensely septic patients. The greatest danger is from peritonitis, if such is not already present, and impossible, with our present technic, to avoid soiling the peritoneum to any extent when the whole uterus is removed. If supravaginal amputation with peritoneal treatment of the stump is practised, soiling the peritoneum may be avoided (v. Herff).

Much more uncertainty exists as to the propriety of removing the uterus in cases of bacteremia, or at least in cases of severe endometritis and uterine pyelitis and phlebitis, when the infection, presumably, is still more or less limited to the uterus. There is the point. If we could tell when the infection is likely to pass the line of safety, we would know when to remove the uterus, and experience has shown that uteri are usually removed too late to do any good, and in

ases, where the courageous operator has done hysterectomy early, he could never be sure that the mutilation of the patient was demanded. The operation may have killed her, or if she got well, may not have contributed to her recovery, but has rendered her sterile. My own experience with the operation is nil—I have never seen a case where I thought it could possibly save life, and in many critical cases recovery ensued without it. If a general bacteremia exists, no one would expect any good from the operation. Williams, Lea, Cragin, Davis, and Edgar take the same position. Septic patients are the very poorest subjects for operations and anesthetics, especially chloroform (L. Guthrie), and there is no doubt in my mind that many puerperæ annually lose their lives because of them.

**Ligation of the Pelvic Veins.**—In 1784 J. Hunter cured a case of pyemia by ligating the superficial vein. Sippel in 1894 proposed it, and in 1897 W. A. Freund ligated thrombotic

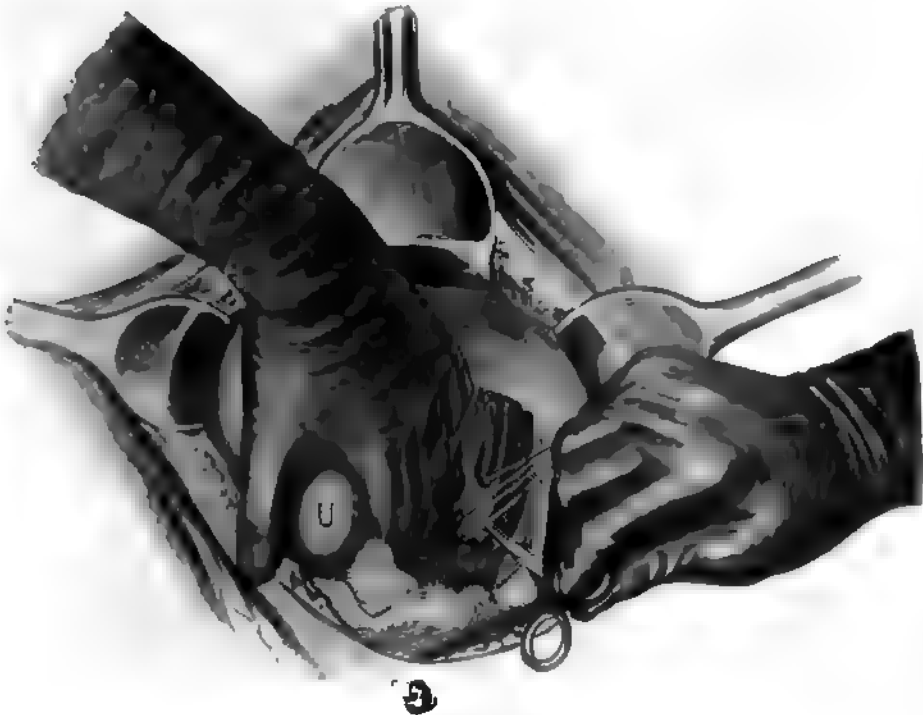


FIG. 767.—LIGATING THE RIGHT MEDIAN AND INTERNAL ILIAC VEINS.  
Modified from Kownatski.

spermatic veins to cure septicopyemia, but without success. In 1902 Trendelenburg reported 4 failures out of 5 operations. In 1909 J. W. Williams collected 56 cases, 5 of his own, of ligation of the pelvic veins, and gives the literature to date. He finds a gross mortality of 43.9 per cent when the veins are attacked from the peritoneal cavity, and he compares this with the general mortality of pyemia, which he places at 66½ per cent. Of his 5 cases, 4 recovered, but none of the patients had had full-term deliveries—one at seven months and four abortions. Miller studied the cases reported up to 1917 and figures a corrected mortality of 32.9 per cent. If the spermatic veins alone are involved, the outlook for the operation is more favorable than if the hypogastrics are affected. If both are thrombosed, or if the infection extends into the cava, operation is hopeless.

After a positive diagnosis of septicopyemia is made, this operation should be considered. Repeated chills, extreme intermittence of temperature, and the palpation of hard, worm-like masses in the bases of the broad ligaments justify the diagnosis of thrombophlebitis, and if the attendant feels convinced that only the veins are implicated, and these not so far as the vena cava, it may be justifiable to remove them from the general circulation by ligating them distally from the infection. In subacute and chronic cases of four to six weeks' duration the most success has been attained, but here also are the most spontaneous recoveries. In acute cases the operation is contraindicated.

All writers agree on the difficulty of selecting the proper ones for the operation, and that the treatment is still on probation. Three methods of ligation are proposed—the extraperitoneal, the operation being similar to the extraperitoneal ligation of the internal iliac artery; the vaginal route, taught by Taylor of Birmingham; and the transperitoneal, the one that seems most rational and is generally adopted. Through a sufficiently large median abdominal incision the pelvis is broadly exposed, the thrombotic veins searched for by sight and palpation, the peritoneum split over them, and a catgut ligature placed beyond the distal end of the thrombus. Both spermatic should be ligated, and also one or both hypogastrics. Bumm once successfully ligated the common iliac vein. Edema of the pelvic tissues and vulva and, sometimes, permanent varices and venous congestion follow the operation when the majority of the veins are tied, conditions resembling the after-effects of puerperal infections with much formation of fibrous tissue about and in the veins and connective tissue (Sanes, Warnekros).

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## CHAPTER LXVII

### DISEASES OF THE BREASTS

#### FUNCTIONAL DISTURBANCES

THE most common disorder affecting the breasts is **simple engorgement**. The **usual** notion is that with engorgement the breasts are overfilled with milk. This is true only in part. While a small amount of milk forms spontaneously in the breasts, the symptoms are due to lymphatic and venous stasis. One can see this in some cases, even the skin being edematous. The engorgement occurs on the second, third, or fourth day, when the "milk comes in," and it may occur at the time of suddenly weaning the child, when the usual relief produced by nursing is absent.

*Symptoms.*—The breasts are very heavy, painful, and hot; they feel warm,



FIG. 768 —MASSAGE OF BREAST. EVEN COMPRESSION OF ENTIRE BREAST. FIRST MOTION.

there is no rise of body temperature. There is no such thing as "milk-fever"—as the ancients ascribed to the engorgement of the breasts on the third or fourth day.

Fever at such time is usually due to infection. Examination of the breasts reveals them to be much enlarged, tender, hard, sometimes edematous, and of a dusky, mottled appearance. The nipple is flattened so that the child cannot grasp it, and the secretion of milk may be suspended—the breasts are choked up with milk. The part of the gland running up into the axilla enlarges too, and the mother cannot bring her arm to the side.

If let alone, the engorgement gradually disappears, the gland becomes soft,



half and with benefit to the nurslings. Ploss says that such a practice is common in Japan, and that the Japanese women, the Chinese, Armenian, and more or less civilized tribes nurse their children for several years—some even up to fifteen. There is a popular fallacy among the poor that nursing prevents conception. Prolonged lactation is usually bad in its effects on the general health of the woman, leading to emaciation, asthenia, oligemia, backache, pain in the breasts, drawing into the axillae while nursing, anorexia, and general neurasthenic symptoms. Head-cramps in the shoulder muscles, amaurosis, and lactation psychoses have been observed. More important is the usual hyperinvolution of the uterus,—so-called lactation atrophy,—which, if the cause is not early removed, may lead to permanent changes in the organ. The uterus is so small sometimes that it can hardly be found. A tuberculous lesion may become active in these conditions. Treatment begins with weaning the child; then tonics, forced feeding, and outdoor living are prescribed.



FIG. 771.—MASSAGE OF BREASTS. THIRD MOTION.

**Galactorrhea.**—Continuous flowing of a milk-like secretion from the breasts, independent of nursing, and persisting after weaning, is called galactorrhea. It is a rare and rather intractable disease. The cause is unknown, but the disease is more frequent in neurotic women, and in some cases abnormal practices on the breasts may be suspected if simulation and exaggeration are eliminated. It may be unilateral or bilateral, intermitting for a few days or weeks, to recur again; may follow abortions or full-term labors, may be slight in amount or profuse, as much as several quarts being lost daily. My case continued for four years, but was free from the flow during two intervening pregnancies, and her milk disagreed with the children, so that they had to be wet-nursed. Recovery occurred when a small sinus near the nipple was opened. Perhaps a chronic galactophoritis may explain some of the cases of galactorrhea. Instances are on record of the flow lasting from ten years to thirty years. The health usually suffers more or less,—a condition called *lactes lactea*,—but it may not be affected at all.

**Treatment.**—Compression of the breast by binder is first practised. Iodid of potash, generally recommended, failed in my own case. A chronic galactophoritis should be looked for, and, if found, the inflamed portion of the breast excised. Chloral, belladonna, antipyrin, bromids, and ergot have all been tried, with varying failure. Return of the menstruation is usually accompanied by stopping of the flow, and therefore, perhaps, efforts to favor the return of the menses may be useful. Attention to the general health is advisable, and a little wholesome neglect of the local condition to distract the patient's mind from it may also be useful. If I should meet another case I would use mammary extract and corpus luteum experimentally.

**Abnormal Milk.**—Remarkable as it may seem, the milk of the mother, although plentiful, may not agree with the child. The author has seen cases where it seemed to act like an irritant intestinal poison, and fatalities have even been reported. These have all been neurotic mothers, and most of them in the higher classes. Chemic and microscopic examinations have not given satisfactory explanations. The condition may or may not recur in subsequent pregnancies.

The child will refuse the breast, in which case the milk may have a foreign taste, or it will vomit the ingested milk or have a diarrhea from it, sometimes with fever. The milk may appear yellower and thicker in these cases, showing either a persistence of the colostrum or an increase in fat and proteids—that is, it is too rich. Curiously, sometimes a child will refuse one breast and accept the other; in a case of this kind the milk of one breast was said to be salty.

If the milk is believed to disagree with the child, causing green, acrid stools, the nursing should be discontinued for forty-eight hours, the breasts being regularly emptied in the mean time by the breast-pump. The child is fed on a substitute milk, and at the end of this period another trial is made of the mother's milk. If it again causes intestinal disturbance, the wisest course to pursue is to obtain a wet-nurse for the child.

If the mother's milk is deficient in one or the other ingredient, the physician will instruct the nurse to give an additional feeding of this or that preparation of sugar, cream, barley-water, etc., after each nursing. Not much may be expected from dieting the mother. Illness of the mother affects the quality of the milk, rendering it indigestible, and also diminishing the amount. Bacteria circulating in the maternal blood are excreted in the milk, which is true of tuberculosis, streptococcemia, pyococcemia, and perhaps for malaria. The infant may be infected from the germs thus swallowed, or from the germs contained in pus which comes from a mammary abscess. Exceptions to this statement are not rare. I have seen septic women, even pneumonia cases, nurse their babies with impunity. A woman with diphtheria, given antitoxin, may nurse. That drugs administered to the mother pass over to the fetus is well known.

Strong emotions certainly affect the milk, causing indigestion, diarrhea, green, corrosive stools, even convulsions and death of the infant, many authentic cases of which are on record.

**Agalactia.**—One of the commonest complaints of nursing mothers is scanty or lack of milk. Total absence of milk is found only when the breasts are absent, a rare anomaly. The causes of deficient milk secretion are general weakness or ill health; malformations or diseases of the nipples, which render nursing impossible or too painful; occlusion of the milk-ducts, or destruction of gland tissue from mastitis; insufficient stimulation of the breast by a puny child; inadequate amount of gland tissue as a congenital anomaly, which might be hereditary, successive generations of women not having nursed their children; disuse of the breast in successive pregnancies; old primiparity—women with the first child after thirty-five seldom being able to nourish the infant; starvation, the wasting diseases, and the effects of febrile affections; emotional states, a quiet, placid disposition contributing to a good supply, worry, fright, pain and anger, reducing or temporarily



stopping the flow; lack of love for the child may reduce the amount; menstruation rarely reduces it; obesity—but not invariably; hemorrhage during labor; interruption of lactation for any cause. The milk usually is not so abundant when nursing is resumed. I have seen the milk return five weeks after the child had been removed from the breast, and cases are on record of its return months afterward. Several reports of nursing of the child by its own grandmother are authenticated, and in certain tribes of savages such a custom is common.

*Symptoms.*—A large breast does not mean a good supply of milk, since it may be made up mainly of fat, with little gland tissue. Small breasts with thin skin and blue veins coursing under the surface usually give plenty of milk.

The symptoms of deficient milk-supply are, first, the distress of the child—its loss in weight; second, pain in the breasts and the absence of secretion. The child is unsatisfied with the nipple; he may suck for a short while, but, finding nothing there, will refuse it and cry. After supplemental feeding he goes to sleep.



FIG. 772.—STIMULATING MASSAGE.

When there is plenty of milk the mother can feel it leave the breast and see the infant swallow. There are also some drops of "white nourishment" around the mouth. These are all absent in agalactia. Weighing the child before and after nursing proves the lack of milk. If the mother persists in nursing after the supply has diminished, the act comes to be attended with pain in the breasts, radiating around to the back, first only during the nursing, later in the intervals also. Unless nursing is interrupted, serious inroads on the woman's health may result.

*Treatment.*—If there is not enough milk in the breasts, an attempt may be made to stimulate the secretion by diet, cool baths, and massage of the breasts, but only a few cases are amenable to treatment. Medicines have very uncertain, if any, action. Malt extract, somatose, or other preparations vaunted to stimulate the secretion may be prescribed. The author's experience with malt preparations is that they often fatten the patient and dry up the milk.

By increasing the liquids in the diet the total quantity of milk may sometimes be increased. When the milk supply is not augmented, the patient is put on fat. Milk may be given in large quantities, also water, very weak chocolate, oatmeal and barley gruels, and oyster-stews, in addition to the rest of the diet. The effect is not permanent, and too much water thins the blood. Alcohol drinks should be restricted, or, better, avoided, and certainly by a mercenary nurse. Alcoholics are not good for the infant.

Cool full baths stimulate the skin and the breast also. They may be taken daily at about 80° to 84° F. The whole body should be briskly rubbed with a coarse towel, avoiding the mammae. Bier's method of producing artificial engorgement has been applied to the breast to stimulate the flow of milk. The results thus far have been fair. Pituitrin has failed, also placenta extract.

Massage of the breasts stimulates the formation of milk. When masses



FIG. 773.—STIMULATING MASSAGE.

the breast for this purpose, the rules given on p. 910 do not apply. One would rather irritate the gland. This is done by raising the whole breast from the chest-wall (Fig. 772) and working it gently between the fingers. Care should be used not to bruise the delicate organ, as an abscess may result. The gland is held against one hand, while the tips of the outspread fingers of the other hand make circular movements all around its periphery (Fig. 773).

Electricity has been tried, with indifferent success. The best stimulant for the milk secretion is a vigorous infant.

One should not be discouraged too soon, as the establishment of the milk secretion is sometimes slow. In one case sufficient milk did not come until the fifth month. Often, after the patient is up and gets outdoors, the milk comes in larger quantities. One may be misled to believe that this is the action of a special drug or of feeding. If, however, the measures instituted have no effect

discontinue them as soon as this fact is apparent. Too great zeal in breasts to act may result in mastitis.

**g up the Milk.**—Of all the measures recommended for this purpose, the found the following the simplest and quickest. Liquids in the diet are saline cathartic given on two successive days, a firm breast-binder is and the breasts then left absolutely alone. Pumping and massage only the gland to further action. Drugs are dangerous or useless. If the nt following the weaning is very marked and painful, the treatment on p. 910 may be employed.

**ed Breast.**—So-called “caked breast” is a local engorgement affecting the lobules or lobes. It is sometimes due to occlusion of one or more of the ducts, but may be a simple congestion, due to injury, which may have the gestation. A lump made up of hard, convoluted masses of gland round occupying one or more quadrants of the organ, which is tender to but presents no signs of real inflammation, nor is there any general reaction. “Caked breast” does not usually lead to mastitis, though it is easy to understand; the bacteria normally present in the tubuli lactiferi could thus more in invasive qualities. If such a breast is roughly handled, as by ill-massage, infection is prone to develop.

**ment.**—Outside of instructing the nurse and the patient to leave the one, to protect them from injury, not to attempt to massage the lumps nothing is done. If the breasts are very painful, an ice-bag or a wet warm may be applied.

#### DISEASES OF THE NIPPLES

Nipples are a frequent complication of the first weeks of nursing. They attract the attention of the accoucheur, because they are exceedingly painful,

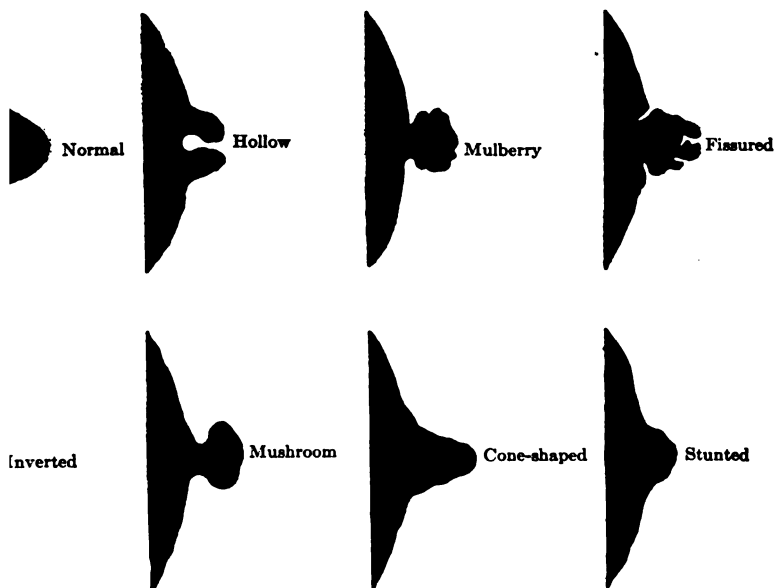


FIG. 774.—VARIOUSLY FORMED NIPPLES.

ent lactation entirely, thus harming the child, and may lead to infection abscesses, which may result in abscess or even in death of the puerpera. Over nursing mothers suffer from sore nipples; primiparæ more than multiparæ; particularly red-haired women, more than brunets, who usually have a thin nipple; old primiparæ more than young ones, and they are especially common

if the nipple is retracted or deformed (Fig. 774). If the nipple is flat or even inverted the child will be unable to get hold of it, and if efforts at nursing are too long

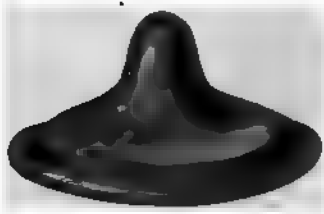


FIG. 775.—WAXENBROUGH'S LEAD NIPPLE-SHIELD.

sisted in, engorgement, cracks, and fissures and, infection being thus introduced, causes sore nipples. The conditions causing sore nipples are erosion, cracks or fissures, and ulcerations. Erosion is caused by the maceration of the thin epithelium by the sucking of the infant, which thus exposes the nipple. Sometimes the epithelium is raised up as a blister by the intense suction, and the blister, bursting, reveals the eroded rete. If infection is added, the sore may become ulcerative. If the skin cracks, infection is especially likely to occur at the bottom

of the crevice in the nipple, a little blood is poured out; it hardens to a scab under which a droplet of pus sometimes is found. Nursing breaks off the crust, and if it is not treated, a deep ulcer may form. Cracks are either circular or vertical. Cracks which run circularly are usually at the base of the nipple, at its junction



FIG. 776.—THE TETTERELLA IN USE.

with the areola, and if the ulceration is deep, the nipple may be partly or wholly amputated. Vertical cracks may split the nipple into two. Bacteria are always present on and in sore nipples, and may cause sickness in the baby. If the mother bleeds, the child may swallow blood, which reappears in the stools or vomit—melena or hematuria. Occasionally slight rises of temperature in the mother are due to infected nipples.

The treatment of sore nipples begins during pregnancy. (See p. 235.)

Woman complains of pain when the child nurses, an inspection of the nipples is to be made—with a magnifying-glass, if necessary. Some neurotic women have pain while nursing, even in the absence of disease of the nipples—sometimes so much that nursing is impossible in spite of sedatives and soothing local applications.

A blister is to be opened by a fine sterile needle and the child withheld from the nipple for thirty-six hours. Cracks and ulcerations are first cleansed with hydrogen peroxid, then one of the following measures employed: Leaden nipple-shields (Fig. 775) are worn between nursings; the crack or ulcer is touched with 2 per cent. nitrate of silver solution morning and night, and this is allowed to dry in the sunlight; the whole nipple may be painted with the same; a 50 per cent. alcohol compress is laid on the nipple for an hour thrice daily; the nipple is exposed to the air under a wire tea strainer; glycerol of tannin, glycerin and boric-acid applications, a salve of equal parts of castor oil and bismuth, may be applied; compound tincture of benzoin, allowed to dry in; collodion. Only the first four are used by the author, and in the order given. A glass nipple-shield is ordered for the nursing. Sometimes a teterelle, used for nursing, as in Fig. 776, will aid in the cure. The attendant is warned to be scrupulously aseptic in the care of the breasts and nipples, because of the great danger of infection. The breast is not to be touched by the nurse, the nipple being washed with sterile boric solution by means of sterilized cotton wound on tooth-picks—the so-called applicators. It may be necessary to stop nursing from the breast until the crack has healed, and if the sore positively refuses to cicatrize, it may be wisest to suspend lactation entirely to prevent a breast abscess. This is especially true of the inverted and deformed nipples, and particularly if the milk is scarce. Such a combination almost inevitably leads to mastitis, which the woman ought to be spared.

### MASTITIS

Inflammation of the breast occurs almost exclusively in nursing women. Cases have been found during pregnancy, even in the non-pregnant, and exceedingly rarely in men. The predisposing causes are cracks, fissures, and ulcers, which in turn are caused by deformities of the nipple and occur in primiparæ oftener. While bacteria are the direct cause of mastitis, and while they may often be found in apparently healthy breasts, an exciting agent is usually necessary. Such are bruising of the breast by injury, which may have been remote, by massage, too much pumping of the breast, squeezing it, or efforts to make it secrete milk when it is physically unable to do so. Simple milk stasis or local or general engorgement seldom leads to abscess, if it ever does, alone.

The germs which have been found in mastitis cases are the *Staphylococcus albus* and *aureus*, the *Streptococcus pyogenes*, the *Bacillus coli*, the pneumococcus, certain anaërobes, the *Oidium albicans*, and blastomycetes (van de Velde). Symbiosis may be present. These microorganisms are brought to the breasts by the hands of the attendants, the linen, etc., or by the patient herself, the usual source being the lochia. In general hospitals unusual and severe infections may be brought to the breasts. The child may be the source of the infection, having thrush or Bednar's aphthæ (the lesions of which usually contain both the streptococcus and staphylococcus), pharyngitis, ophthalmia, coryza, or pemphigoid or pustular eruptions on the face, etc. Without doubt some of the cases are caused by the attainment of invasive qualities of the bacteria normally inhabiting the outer milk-ducts in the nipple. In 1893 I proved that the staphylococcus existed in the milk of apparently healthy women. When the breast is overstimulated or hurt, the bacteria invade it. Finally, it is possible for the germs to get to the breasts via the blood, as is sometimes observed in septicopyemia, but this is very rare.

**Forms of Mastitis** (Fig. 777).—The infection may be limited to the areola outside the lamina cribrosa, forming an abscess running around the nipple, or in one of the tubercles of Montgomery, or in the milk-glands attached to them;

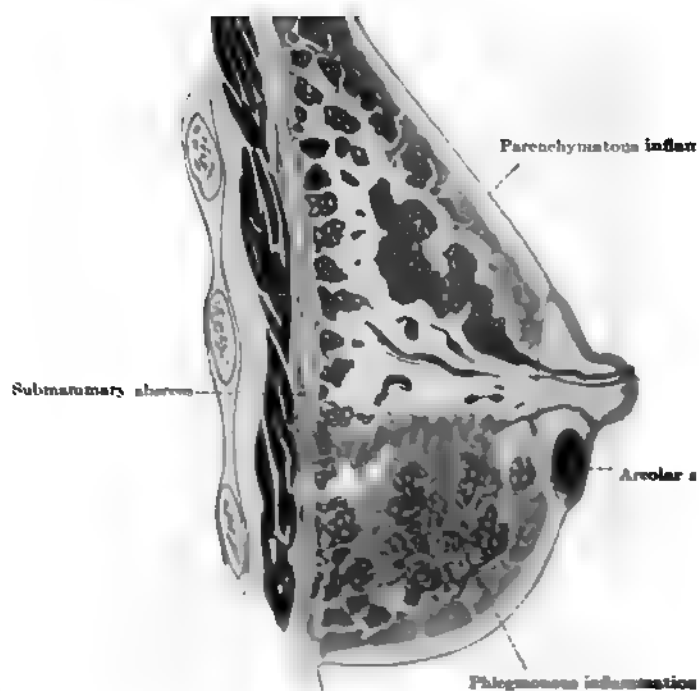


FIG. 777.—DIAGRAM OF BREAST INFECTIONS.

and begins seldom before the seventh day of the puerperium—more often to the twentieth day. Frequently there is a little pain in the breast, marked while nursing, and occasionally slight fever— $99^{\circ}$  to  $100^{\circ}$  F. preceding the outbreak. This is manifested by a more or less severe fever. The temperature may reach  $106^{\circ}$  F. and be accompanied by a more or less severe fever. The temperature usually does not go over  $103^{\circ}$  F., and the febrile symptoms are more marked when the breast is the rule, and over the lobe affected redness and tenderness are shown, and usually the nipple will show a fissure, the site of entrance.

- redness of the skin, with a bluish tinge indicates where the pus is coming to the
- surface. Unless promptly operated, successive lobes are involved until the whole
- breast is riddled with abscesses. These must all be opened and drained, healing
- often requiring weeks or even many months. Naturally, in these cases the cellular
- tissue is also involved. Sometimes the acute symptoms subside and the accoucheur
- believes the process is at an end, but a few weeks later fever begins again and the
- breast suppurates, or pus is evacuated through the nipple.

In the cellultic or phlegmonous variety the infection travels into the gland from

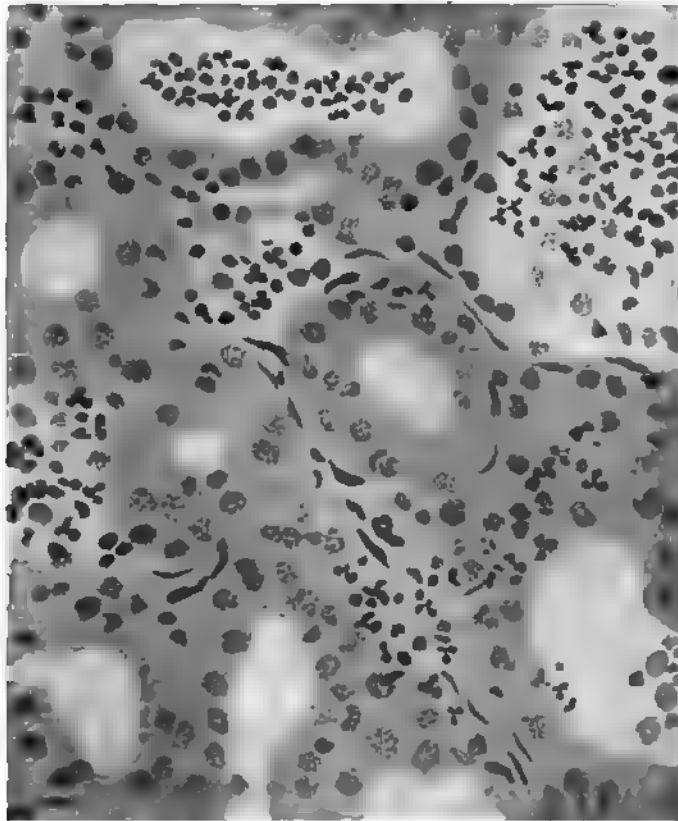


FIG. 778.—MASTITIS PURULENTA.

a fissure and along the connective-tissue septa, and redness, fan-shaped, spreading from the crack, may be seen around the nipple. If the deeper lymphatics are involved, the case resembles one of deep cellulitis anywhere, with brawny swelling of the skin. Usually the streptococcus is here concerned,—at least some heterogeneous bacterium,—and such cases are more frequent in general hospital practice. The fever, though at first less intense, keeps up longer, and the pulse more quickly feels the effect of the toxemia. Erysipelas has been observed, and even a pan-mastitis. Suppuration is much more common in this form of mastitis, but often, too, the breast shows only a firm infiltrate, which may be absorbed in from six to twelve days. After three or four days it is possible to foresee which termination is to occur. The axillary lymphatic glands may be enlarged.

In the submammary abscesses, which Billroth believed were due to suppuration of deep-seated mammary gland tissue, the pus collects behind the gland, which then seems to float on a cushion, and edema appears at the periphery. The general symptoms are most threatening in this form of infection—indeed, unless promptly evacuated, the pus may burrow far and the patient die of bacteremia.

**Treatment.**—At the beginning it is not always possible to determine whether the infection is of the parenchymatous or the cellulitic variety, but the treatment is the same for both. The following practice has been found very successful by the author: (1) Remove the infant from the breast, and from both breasts if the symptoms are not very mild; massage and pumping the breast are forbidden; (2) administer a brisk saline cathartic; (3) apply a tight breast-binder; (4) put two or three ice-bags on each breast. After gently squeezing the nipple to evacuate a possible pus sac, it is surrounded by a ring of cotton; a layer of the same is laid between the two breasts; a rolled towel is placed to support the organ from the axillary side, and the breasts, lifted up, are tightly bandaged. The ice-bags must keep the breasts cool, but the nurse is instructed to watch the skin for signs of freezing, which, by the way, I have never seen with this treatment. After the temperature has been normal for twelve hours, the bags are removed one by one, and in twenty-four hours the child may be put back to the breast. This treatment is more successful in the parenchymatous forms than the cellulitic.

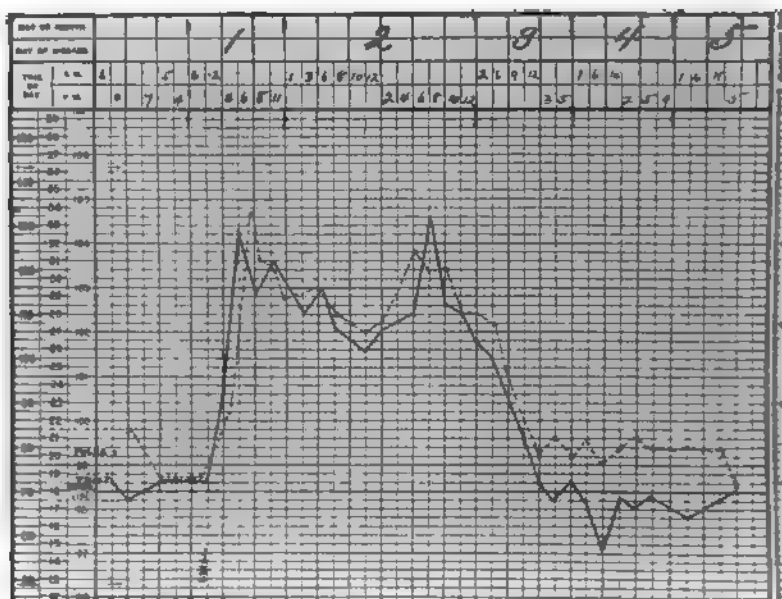


FIG. 779.—ACUTE DOUBLE MASTITIS. NO ABSCESS. RIGHT BREAST FIRST.

If an abscess forms, it must be incised as soon as diagnosed. If the attendant is certain that suppuration has begun, the ice is replaced with a hot wet boric dressing. In opening breast abscesses the operator should make a long incision in a line radiating from the nipple, and with the finger he searches out all the pockets of the particular lobe involved. If more than one lobe is suppurating, an incision is made into each one and pus pockets cleared, the septa between them broken down, and adequate drainage provided by tubes and gauze. This procedure is an extensive operation, and is often followed by chill, fever, and aggravation of the symptoms, sometimes with septic eruptions, but these subside within thirty-six hours, and the patient goes on to recovery. Occasionally, especially if the primary operation was not done thoroughly, new portions of the breast break down, forming secondary abscesses which may riddle the breasts, and these may protract the healing for months. I have noticed that if such pockets are not immediately opened, but left for a few days and then incised broadly and the cavity rubbed briskly with the finger (gloved), a sort of auto-inoculation or vaccination is made, which has a good influence on the whole gland. The sinuses drain better under a wet dressing, which is at first renewed thrice daily; later, less often. Attention must be given to building up the general health, which is likely to suffer from the profuse suppuration and prolonged illness. The patient is to be gotten out of bed and out-of-doors as soon as possible.

When the sinuses are very persistent and new foci of suppuration constantly appear, vaccine treatment is to be tried. It is best to get the bacterium, usually the *Staphylococcus albus*, from the patient and make an autogenous vaccine, giving first 5,000,000, then in a few days 25,000,000 or 50,000,000, if necessary.

The author has used the Bier treatment on several cases of mastitis, and does not find that it materially shortens the length of the suppuration, nor does it enable one to dispense with large incisions.

In the cellulitic variety of mastitis, if diagnosed early, a hot, wet boric dressing covering a large part of the chest would be better than the ice. Incision is to be delayed until definite suppuration is discovered. Surgeons are divided as to the propriety of incising cellulitic mastitis early. Judging from my experience in treating cellulitis in the pelvis, I would wait for actual pus-formation. Submammary abscess is to be opened at once by broad incisions at the periphery of the gland.



The excessively rare carcinoma and adenomata of the breast deserve mention, although an experience comprising the pathology of over 31,000 obstetric cases carcinoma of the breast was found only once.

### SUNDRY COMPLICATIONS OF THE PUERPERIUM

Naturally, a puerpera may suffer from any of the diseases she would contract under other conditions, without any bearing on the puerperal state. A few of these deserve special mention.

**Fever from Emotional Influences.**—See p. 892.

**Fever from Constipation.**—Without doubt, overloading of the bowels may cause fever during the puerperium, but such cases must be extremely rare. Almost invariably a temperature that at first was ascribed to stercorrhemia is found later to be due to an infection in the pelvis or the breasts. The diagnosis must be made by exclusion, which is admittedly a precarious method. The therapeutic test—subsidence of the fever following brisk catharsis—is absolutely unreliable, because—(1) Energetic action of the bowels may affect the uterus and stimulate it to contraction, expelling from its cavity clots, lochia, and detritus; (2) the pelvic circulation is hastened by the cathartic, an action most exhibited by aloes, and the relief of an overloaded rectum improves the currents of the blood and lymph in the pelvis; (3) some cathartics produce leukocytosis, which aids in repelling infections; (4) a full rectum may cause lochimetra or stasis of lochia in the vagina—its emptying and the bearing-down efforts of defecation relieve the stasis. Therefore, if the fever subsides after the bowels are emptied, the case may have been one of infection, and not of absorption of toxins from the intestinal tract, as supposed.

Budin, in 1892, called attention to febrile stercorrhemia, and Küstner, Oui, Lavergne, and others have reported typical cases. Fever, headache, anorexia, sometimes nausea and abdominal pain, are the symptoms. The tongue is heavily coated, the breath fetid, the skin muddy or pasty, the belly distended with gas or doughy to the touch over the large bowel, and often tender. The lochia, usually normal, may have a fecal odor (colon bacillus), but the uterus and adnexa are normal. Brisk catharsis and enemata produce copious fetid evacuations, after which the symptoms subside. When the rectum is packed with hardened feces, it may be necessary to inject a softening enema (1 dram inspissated ox-gall triturated in 1 ounce of glycerin, to which are added 2 pints of water). After this has acted for an hour the softened mass may be removed by the gloved fingers, aided by rectal irrigation of saline solution.

**Tape-worms** have often been expelled during the puerperium. Fever has occasionally been ascribed to them, but in three of my cases they existed without causing temperature. The treatment is the usual one, but the child is to be kept away from the breast for the two days required for the action of anthelmintic remedies.

**Tympany and Ileus.**—Tympany occurring after delivery seldom becomes obstinate or very marked, and gives no concern if the bowels are moving and the general condition is not affected. If the distention does not quickly subside under the usual treatment (a cathartic, carminative enemata, a 5-grain asafetida pill three times daily), the possibility of a serious affection should be entertained, and a careful search made for a cause.

Obstruction of the bowels may be due to kinking from adhesions, the sequelae of former operations or inflammations, and requires the usual treatment. In one case I found that a retroverted puerperal uterus compressed the rectum. After raising this up with one finger in the bowl the obstruction was relieved.

Ileus after cesarean section is the same as that met so often by surgeons, but it may follow operative deliveries from below—hysterosotomy, even natural deliveries. Sometimes an acute dilatation of the stomach is the cause, and, again, paralysis of the small intestine or occlusion of the large bowel. Bruising the bowel when the uterus is massaged, kinking from adhesions, compression of the bowel by the retroverted uterus in the pelvis, thrombosis of one of the celiac or mesenteric arteries, and unrecognized rupture of the uterus, rupture of a pus-sac, rupture of the gut with beginning peritonitis—all these may cause excessive tympany and ileus postpartum. Infection of the peritoneum from some cause must always first be thought of in these cases. The diagnosis is the most important part of the treatment. If it is decided not to open the abdomen, the following measures may be tried: repeated enemata, of which the milk and molasses combination,  $\frac{1}{2}$  pint of each, is the best; this may be given with the patient inverted; turning the patient on her stomach; elevation of the head and shoulders; 5-grain asafetida pills thrice daily; washing out of the stomach (very useful); eserine,  $\frac{1}{10}$  grain hypodermically every four hours for four doses; pituitrin; puncture of the gut with a fine needle—while said to be safe, to be used only as a last resort. The same is said of making an intestinal fistula.

**Fissures in ano** are a not infrequent complication of the late puerperium. Inspection readily reveals them, and stretching of the sphincter with a speculum and a few applications of (10 per cent. silver nitrate solution to the cracks as readily cure them. Oil enemata and free action of the bowels strengthen the cure.

**Difficulty of Urination.**—This subject has already been touched upon (p. 334), and here need be mentioned only the overfilling of the bladder, with dribbling (incontinentia paradoxa); overfilling with only partial emptying of the bladder (evidenced by pain in the belly, a displaced uterus, a soft tumor above the pubis, sometimes tympany, and lochiostasis and fever); and the dribbling of urine which comes through a vesical fistula or paralysis of the sphincter vesicæ.

**Exhaustion psychoses** may occur after prolonged and arduous labors in weakened individuals, and I have seen "SOLDIERS' HEART" in a few cases. The symptoms are exhaustion, dyspnea, and palpitation of the heart on exertion, precordial oppression, giddiness, tremor, nervous instability. I have observed these symptoms also after serious gynecologic operations.

**Gall-stone colic** seems to be favored by the conditions in the puerperium, but, as Prochownick says, they may be simulated by disturbances of pancreatic function. (Monat. f. Geb. u. Gyn., September, 1916, No. 3.)

## PART III

# OPERATIVE OBSTETRICS

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### CHAPTER LXVIII

### GENERAL CONSIDERATIONS

DURING pregnancy and labor the accoucheur's duty to his patient is both prophylactic and remedial. After providing for the gravida as described in the Hygiene of Pregnancy, p. 230, his course is one of watchful expectancy. He simply studies the processes of nature and determines when, where, and how he may be of assistance, but he must always bear this in mind, that he never can be of "assistance" unless something in the course of pregnancy, labor, or the puerperium goes wrong. Under such circumstances he makes up his mind that he must interfere. This is the first; second, he studies what he must do, and third, when he should do it. That something in the course of pregnancy, labor, or the puerperium which commands interference, or any mode of treatment, is called an "*indication*." The many features of each obstetric case are the factors which determine or specify the nature of the procedure to be instituted. We call them "*conditions*." A condition, therefore, is a prerequisite which must be fulfilled before the procedure demanded by the indication may be carried out. The study of the case, and the determination that there is a reason for the adoption of a particular line of treatment, we call "placing the indication," and this requires very delicate balancing of all the conditions. Speaking broadly, all *indications* for interference lie in the presence of immediate or prospective danger to mother or child. The *conditions* will be found in the state of the mother at the time of the intended treatment. Only when the conditions necessary for carrying out the procedure are present may we act, but the indication may be so strong that we have to "force the condition." For example, a woman has eclampsia. The indication is to empty the uterus, but the cervix is tightly closed. A condition for rapid delivery is an open cervix; therefore we must first open the cervix, or choose an operation which has not this binding condition. A condition which absolutely prohibits a given line of treatment we call a "contraindication."

**Selection of Operation.**—This will depend on the indications and conditions, but often there are other considerations, as the skill of the operator, the environment of the patient, the religion of the family, the desires of the parents. An unskilful practitioner, unless he can obtain competent counsel, should always do that operation which promises the greatest safety to the mother. If the patient is amid bad surroundings, it may be necessary to sacrifice the child, while if she were in a good maternity, cesarean section would save both. A Catholic family does not permit craniotomy on the living child, and a husband may absolutely demand that his wife be subjected to no added risks for the sake of the child. These points will again be considered.

**Diagnosis.**—Before every obstetric procedure the accoucheur must have made a careful *general* examination. He must know the exact condition of the kidneys, heart, lungs, thyroid, blood, etc. Just before an operative delivery, with the pa-

tient on a table and perhaps anesthetized, the examination of the local conditions—presentation, position, attitude of the child, the state of the cervix, etc., must be repeated, because things may have changed in the time intervening, or the first diagnosis may have been wrong. If the local findings are different from what was expected, the original plan of procedure must be dropped or altered. Any other course which might be taken to save the accoucheur trouble and mortification usually results in more of each for him, and endangers the patient. It may be wisest to put the woman back in bed and select an entirely different line of treatment.

After the diagnosis is made and proved, the operator may well rehearse the steps of the operation in his mind beforehand, and take cognizance of the various complications which are likely to arise. If he will construct a mental picture of the conditions before him and then do the operation, as it were, "in the air," before the patient, he will be surprised how much the correct procedure is facilitated.

**Assistants.**—For good surgical operating at least three assistants are required—an anesthetist, a first assistant, and a nurse to hand instruments. Most surgeons demand more help than this, but most accoucheurs are satisfied with less. Why an accoucheur should, voluntarily, deny himself, the patient, and the baby the benefits of sufficient help is incomprehensible. In private practice it is often impossible to obtain more than one assistant to give the anesthetic, and the nurse must do all the rest of the work. Sometimes there is no nurse even, and the accoucheur has himself to give the anesthetic while operating. If the general practitioner would equal the work done in the maternity hospitals, he must educate the public to allow him sufficient help, and it can be done easier than he thinks. Circumstances are very unusual where another physician, one or two medical students, or one or two extra nurses are not obtainable. It is unsafe to trust the husband to help or to hold a light. He may collapse; further, it is cruel.

**Examination of the Patient after Delivery.**—I have made it a rule to examine the parturient canal from the fundus to the vulva and the adjacent viscera and pelvis after every operative delivery. The hand is inserted into the uterus, palpates the placental site, removing adherent placental fragments, decidual débris, membranes, and blood-clots, then encircles the lower uterine segment three times, going from right to left, and three times from left to right—this in order to discover a slit-like injury—then the vagina likewise, and then the vulva. Tears of all degrees are carefully searched out. The pubic joint is palpated, the bladder catheterized, and finally, after all repairs have been made and just before applying the vulvar dressing, the finger is passed into the rectum to find out if any stitches have been put through it or if it is otherwise injured. The accoucheur must know and record the location and extent of all the puerperal wounds. Only by such routine, thorough, painstaking examination may a rupture of the uterus and other injuries be discovered, and I omit it only when there is no possibility of injury and when there is evident infection of the vagina. Here, I examine the cervix at least. Under the protection of sterile rubber gloves and thorough antisepsis of the vulva and vagina the procedure is safe.

After operative deliveries the child, too, requires a careful gentle examination of the head and all its members. It may not be so easy to discover a skull fracture or a broken clavicle as we would like it to be.

**Reflection.**—A most profitable procedure after it is over is for the accoucheur to review all the details of his case and what he has done, considering the result, and examine himself to see if his judgment has been good and his technic perfect; then to decide what he would do in a similar case or if the same woman became pregnant again. All these impressions should be written on the history card. They will be invaluable for future reference and also for individual improvement.

**Anesthetic.**—The reader is referred to the chapter on Anesthesia in Normal Labor. For many operations an anesthetic is not necessary, though occasionally



the leggings are not touched by the operator. If he does so inadvertently, he washes his hands in the solutions. The assistants holding the legs wear gloves. If called upon to hold instruments, etc., they too wash in the antiseptic solutions.

In private home practice, although all the sheets, towels, leggings, etc., are sterilized when they have been put on the patient, the accoucheur should touch them as little as possible. *Only the area immediately around the vulva, which has been disinfected and is frequently drenched with antiseptic solutions, and the towel over the abdomen, are to be considered sterile, and may be touched by the accoucheur.* If he will practise this principle as a habit, he will be able to carry out the most complicated obstetric procedures amid the most discouraging surroundings, with greatest safety. Our operating-rooms err in this regard. The sterile field of operation is made too large. The absolute sterility of the immediate site of the operation and of the instruments, sponges, etc., which come into it is the bacteriologic laboratory idea of asepsis, and, to my mind, the correct one—certainly for private practice. If everything else is considered infected, it is not so hard for the operator and his assistants to preserve the asepsis of the actual field of operation.

During the course of the operation, especially if prolonged, the vulva and thighs are frequently swabbed with antiseptic solutions—1:1500 bichlorid and 1 per cent. lysol solution. If feces escape from the anus, they are received with the greatest care in pledgets soaked in bichlorid solution. If the rectum is very full, it may be advisable to wash it clean with sterilized saline solution. To try to keep fecal matter away from the field by holding a towel or swab over the anus is fatuous—the feces are simply smeared all over the perineum by such procedures. It is best to see what becomes of the evacuations, and disinfect the anus continuously, taking extra care during all manipulations not to pass the hands, instruments, or gauze near the source of infection. After delivery, if much use has been made of strong antiseptics, it is a good plan to wash the parts with sterile water, to prevent an eczema.

Aseptic technic is not the final word in the prevention of infection. Good operative technic, the preservation of the woman's immunities, the prevention of shock and hemorrhage, proper selection of operation, etc., contribute certainly as much to success.

#### Preparation of Patient for Operative Delivery.

—If the woman has not been prepared as already described on p. 283, she is gotten ready for operation just before the anesthetic is started. The operator first sterilizes his hands. The vulva is shaved, scrubbed with soap and water, the smegma under the hood of the clitoris removed with oil or vaselin, and the parts thoroughly washed with both lysol and bichlorid solutions. The vagina, too, is mopped out with lysol solution, care being taken to rub lightly and not destroy the epithelium too much. In order to prevent hairs and wash-water dripping into the vagina during the shaving and washing, a large swab soaked in antiseptic solution is packed into the introitus. After everything else is disinfected, the swab is removed and this part and the vagina are attended to. If the patient had already been prepared for normal labor, all that is needful is a thorough washing with the antiseptic solutions. Painting the parts with tincture of iodine is practised by some operators. In all cases the accoucheur must be sure that the bladder is empty.

**Arrangement of the Room.**—Fig. 781 is a diagram of a room in a private home, and Fig. 782 shows the arrangement of tables, etc.

Provision for good light is essential. An acetylene bicycle lamp or the lamps from an automobile I have many times found useful.

The kitchen or library table makes an excellent operating-table, and should always be used. It is unfair to the woman, the baby, and the doctor to operate



FIG. 780.—GOWN FOR OBSTETRIC OR SURGICAL OPERATIONS. Long gantlet gloves, head and mouth and nose-piece.

on a woman lying across the bed. When the surgeons do appendectomies, or gynecologists vaginal hysterectomies, with the patients lying in their beds, it is justifiable to perform obstetric operations in such fashion. I have pe

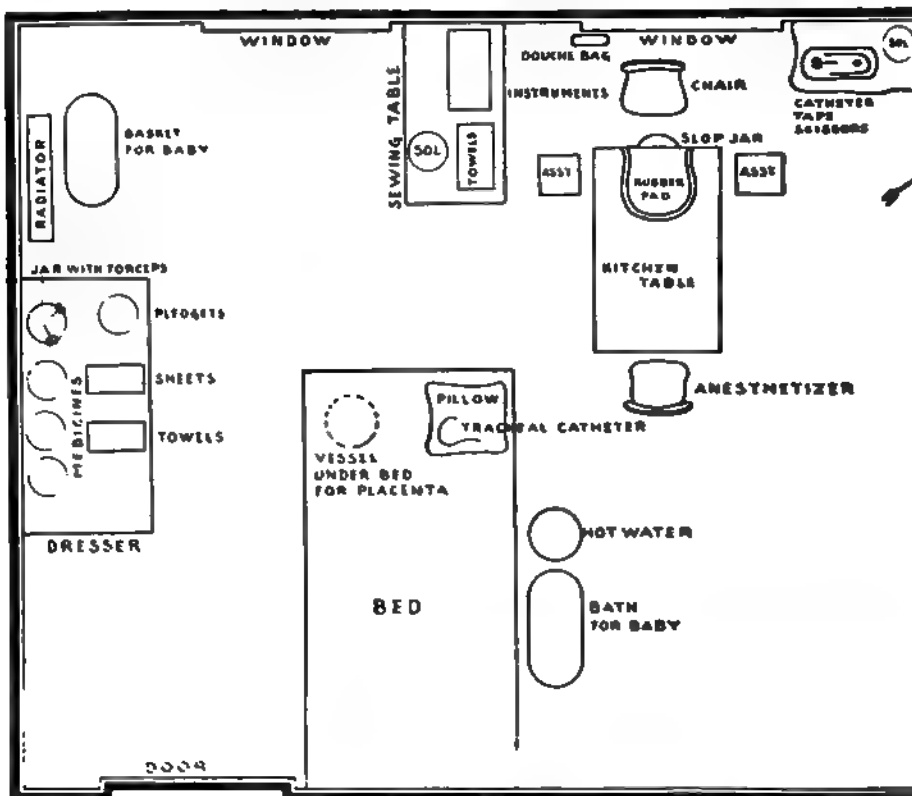


FIG. 70. PLAN OF ROOM ARRANGED FOR OPERATION.



FIG. 71. ARRANGEMENT FOR AN OBSTETRIC OPERATION. (Note the position of the patient and the location of the instruments and the anesthetizer.)

It is important to note the position of the patient and the location of the instruments and the anesthetizer. The patient is lying on the bed, and the instruments are placed on the table. The anesthetizer is positioned near the patient's head. The room is arranged to facilitate the operation.

o reason that better work can be done on the table, and, further, the dignity of the specialty of obstetrics is concerned. Even the specially constructed obstetric beds do not possess the advantages of a table.



FIG. 783.—PATIENT POSED FOR OPERATIVE DELIVERY. ASSISTANTS HOLDING LEGS.



FIG. 784.—PATIENT ARRANGED FOR OPERATIVE DELIVERY WITH SHEET SLING TO HOLD LEGS WHEN SHORT OF HELP. Note sheet tied below knee and drawn over shoulder.

**Posture of Patient.**—In America and in Continental countries the parturient is always placed on the back for operative delivery or other obstetric operation.

England alone uses the side position, but less now than formerly. Kerr uses it only for low forceps operations. Fig. 783 shows the most convenient posture. In cases of shoulder presentation, or in breech, when it is desired to get the presenting part away from the inlet, the head of the table may be lowered, as described by



FIG. 783.—AUTHOR'S OPERATION TELESCOPE. PORTABLE STERILIZER, TELESCOPED, AT THE BOTTOM

Richardson, a combination of lithotomy and Trendelenburg positions. In some cases it is necessary to turn the woman on her side for a few minutes—for example—to grasp the anterior foot in back-posterior shoulder presentations. The woman's leg then is simply lifted over the head of the operator, and replaced after 10 or 15

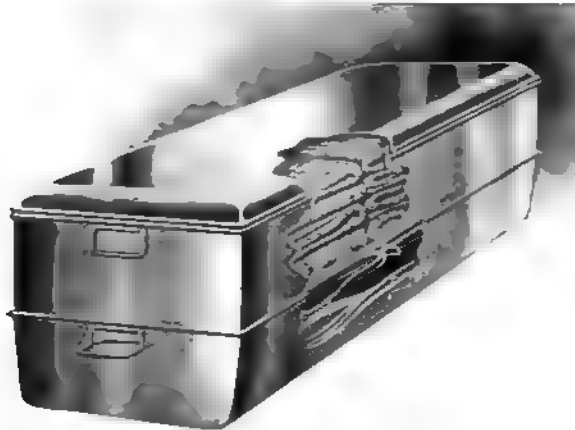


FIG. 786.—AUTHOR'S PORTABLE STERILIZER, READY FOR STOVE, WITH INSTRUMENTS IN PAN. SHEETS AND TUBS IN UPPER COMPARTMENT. THE PAN CONTAINING THE INSTRUMENTS IS TELESCOPED IN THE TRAY FOR PAN

grasped the foot. A few operations—replacement of cord, disentanglement of locked twins—are performed with the patient in the knee-chest position, and I have operated on several women, pulseless from hemorrhage, with the body suspended head down from the shoulders of two assistants. The ease with which version can be done in this posture is surprising. Walcher's position (Fig. 655) is



aid the passage of the head through the inlet, and the exaggerated lithotomy is passing the bony outlet (Fig. 495, p. 588).

**strumentarium.**—In city and town practice it is not required to take to the case a complete obstetric outfit. The satchel shown on p. 278 meets all the needs of the usual labor and the operations most commonly performed. If a forceps or a version, or the care of placenta prævia, eclampsia, etc., is to be attended, or if the woman lives far from the operator's base of supplies, a complete obstetric armamentarium must be at hand, and such an outfit, if the accoucheur is to be abreast of the times and give his patient the benefit of his art, must be a comprehensive one. Fig. 785 shows the author's obstetric bag for operative cases, Fig. 786, the portable sterilizer. The instruments are packed in the pan of the satchel; the other articles are arranged, without any especial order, in the upper part of the telescope. I have found it impracticable to have special cases or compartments made for each article—the satchel is complicated enough without.

The instruments may be divided into sets for perineorrhaphy, for forceps, for lithotomy, and wrapped in separate towels.

#### LIST OF ARTICLES IN TELESCOPE

- 1 complete operating dress, trousers, sterile gown, head-piece.
- 4 pairs sterile rubber gloves, long and short.
- 2 sterile hand-brushes.
- 2 jars sterile antiseptic gauze, one piece 12 yards and one 8 yards long.
- 4 jars sterile cotton and gauze swabs.
- 4 ounces French gelatin, or, better, 2 ampules Merck's sterile gelatin.
- 1 douche-can with sterile rubber tube and salt solution needle.
- 3 tracheal catheters, 2 rubber catheters.
- 1 box containing ampules of sterile epinephrin solution, pituitrin, aseptic ergot, hypodermic digitalis and veratrum.
- 1 glass hypodermic syringe—to be boiled for cesarean section.
- 1 sac containing a small bottle of fluidextract of ergot; a vial with tapes for the cord (sterile); a vial of bichlorid tablets; four ounces of liquor cresolis compound (lysol); a vial of sodium bicarbonate or borax (for boiling instruments); a glass, screw-cap bottle of sterile silkworm-gut in 1:500 bichlorid solution; a bottle of 25 per cent. argyrol solution or 1 per cent. silver nitrate; a baby scale, and a tape-measure.
- 1 dozen tubes of sterile chromicized catgut, Nos. 1 and 2.
- 2 cans of ether. A mask. A stethoscope.
- 1 set of history sheets for the nurse. Labor cards and birth-certificates.

#### LIST OF INSTRUMENTS

- 1 pelvimeter and 1 cephalometer.
- 1 sac containing a set of Voorhees' rubber bags, all sizes, 2 Carl Braun colpeurynters, 2 large Müller bags (like Voorhees', but larger), and a bulb syringe with metal joints.
- 3 obstetric forceps. One small one for little babies, the ordinary Simpson forceps, and the same with longer shanks for high operations, or an axis-traction instrument.
- 8 long pedicle clamps; 2 angular clamps.
- 8 ordinary artery forceps.
- 3 needle-holders—one long.
- 1 scalpel.
- 3 scissors.
- 4 retractors—various sizes.

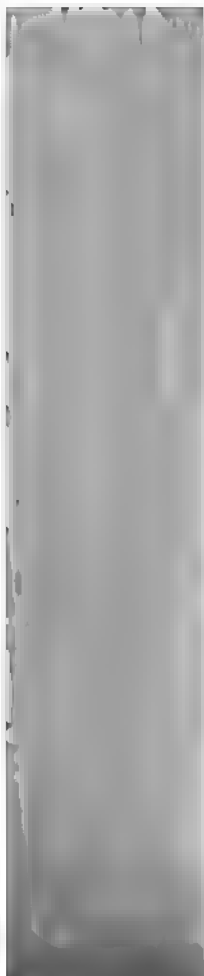


FIG. 787. -METHOD OF INTRODUCING HAND TO AVOID CONTAMINATION FROM

Previous to operation the instruments required are boiled for a 1 per cent. soda or borax solution in a covered vessel. This and the operator serves himself with them from the open trays side him.

*Care of Feces Issuing from the Anus.*—This is a very unwelcome complication of any obstetric operation, because it requires the most constant watchfulness and the greatest dexterity to avoid transporting the infectious material into the genitals. Sometimes the feces contain only saprophytic and harmless organisms—a fact which is proved by the rarity of serious infections, when we know how often fecal matter is brought into the vagina, but occasionally the *Streptococcus pyogenes* and the gas bacillus in virulent condition exist, and fatalities in considerable number are on record. Measures should have been instituted beforehand to provide for such a contingency, that is, a cathartic administered early in labor, and an enema given to wash the lower bowel clean. If labor lasts several days, these are repeated—taking care that it be not too shortly before delivery.

If the bowels move as the operation is begun, the rectum should be emptied by squeezing out its contents from the vagina, using two fingers. I prefer not to irrigate the rectum with sterile water unless the head is well down in the pelvis and checks the further downpour of fecal matter. Hard feces are easier to manage than clattering liquids. After the rectum is emptied a pack of sterile gauze may be inserted temporarily, but only until the presenting part comes down onto the perineum. Then it is to be removed, otherwise the bowel will be injured during delivery. For the same reason a suture around the anus is hazardous. The anal region must be constantly inspected during the delivery, and, as feces exudes, it is carefully received in wet antiseptic gauze or cotton, the parts then being liberally washed with 1:1500 bichlorid and 1 per cent. lysol solutions. Whenever the hand is inserted into the vagina, it is passed from above under the pubic arch, the possibility of contamination being always kept in mind (Fig. 787). To try to preserve asepsis by fastening a towel or pad over the anus is illusory—the feces being thus simply plastered all over the perineal region from the inside of the cloth, even damming back up into the vulva. Urine may also be infectious, especially if the woman suffers from pyelitis or pharyngitis.

## CHAPTER LXIX

### PREPARATORY OBSTETRIC OPERATIONS

**Opening the Cervix.**—The state of the cervix is a condition which governs indications of most obstetric operations. In eclampsia, placenta prævia, and diseases demanding immediate emptying of the uterus the state of the cervix a guiding influence in the choice of procedure. We have many methods of gain



FIG. 788.—UNDEVELOPED CERVIX.  
A laceration at this time enlarges vessels and peritoneum.



FIG. 789.—SHOWS VESSELS AND PERITONEUM RETRACTED AWAY FROM ORDINARY DANGER.

access to the uterus—some slow, some rapid. The slow ones are those which the uterus into action to aid in the dilatation, and the process resembles not labor more closely. Packing the cervix and metreuryis are slow operations, in some of the more rapid ones uterine action also aids the process in a small degree, as in manual dilatation and the employment of the Bossi dilator. following operations are done to open the cervix: Packing the cervix and uterine segment with gauze; manual or digital dilatation; metreuryis; mechanical dilatation with metal instruments; radiating incisions in the cervix; vaginal

arean section. Which of these methods will be the one selected will depend—(1) on the condition of the cervix, whether it is tightly closed, or already more or less effaced or shortened or drawn up into the body of the uterus; (2) on the urgency of



FIG. 790. UTERINE PACKING TUBE FOR USE AFTER THE SIXTH MONTH.

The tube has a lumen  $\frac{1}{8}$  inch across. Gauze 3 inches wide or a knit bandage is used for packing. It is sterilized as described in the Appendix, and preserved in hermetically sealed bottles. It is served directly from the bottle. Smaller tubes and narrower gauze are used for abortion cases.

the case and the nature of the complication demanding the interference; (3) on the skill of the operator; (4) on the environment of the patient.

It is of greatest importance to distinguish between a cervix that is already



FIG. 791.—PACKING LOWER UTERINE SEGMENT AND CERVIX FOR INDUCTION OF LABOR.

Catching the end of the gauze strip from the bottle, which is held near the vulva, by means of the trident plunger, the gauze is pushed the whole length of the tube. Now, under the guidance of the two fingers, placed in or against the cervix, the tube is inserted into the lower part of the uterus. With short in-and-out strokes of the plunger the gauze is deposited above and in the cervical canal, taking care to distribute it evenly and not to rupture the membranes. This is easily accomplished by moving the end of the tube in circles and retracting it as the cavity fills up. From three to five yards may be inserted. In most cases the vagina need not be plugged. It is occasionally needed in abortions.

effaced or obliterated and one that has not been at all taken up, and also to know how far the process has advanced. During the effacement and dilatation of the cervix the pelvic connective tissue is drawn up out of the pelvis; the bladder is drawn up, and its attachment to the cervix loosened and displaced upward, the ureters going

with it; the peritoneum is elevated; the broad ligaments unfolded; and the vessels at the sides of the uterus raised up and retracted, sometimes even above the brim. This means that these important structures are removed from the place where they are subject to injury from below (Figs. 788 and 789). In principle this unfolding of the cervix may occur to some extent in the last weeks of pregnancy and is sometimes accompanied by fugitive labor pains, and this is also true of paræ, in whom there is an additional softness of the tissues. Artificial opening of the cervical canal is easiest in the last weeks of pregnancy, but even then it



FIG. 792.—DILATING EFFACED CERVIX WITH FINGERS.  
Illustrates wedge action.

danger of deep lacerations, and the more nature has opened the cervix, the less the accoucheur has to do. Figure 793 will give an accurate idea of the location of the uterine artery, and Fig. 886 on page 1023 shows the development of the uterine veins. The latter are really more important in this connection.

**Packing the cervix** is shown in Fig. 791. It may be employed to start labor (Hofmeier, 1888), to induce abortion (Wyder, 1888), to soften and dilate the cervix preparatory to the insertion of a colpeurynter, and to stimulate the labor-pains in the first stage. Ordinarily, if not already present, pains set in within eight hours, but sometimes not for twenty-four, when the first pack



FIG. 793.—UTERINE ARTERY AND URETER. DILATATION ALMOST COMPLETE.  
Adapted from Couvelaire.

removed and another inserted, if needed, or other methods adopted. This simple operation may be done when the cervix is closed. Anesthesia is rarely required. I have never found it necessary to use a metal dilator after the sixth month to procure enough dilatation to pass the tube, of which there are several sizes, with gauze to fit. It may be done safely at home. It is not useful in urgent cases nor in placenta prævia. The dangers are infection (which can be avoided), rupture of the membranes, which may allow prolapse of the cord, separation of the edge of the placenta if situated near the internal os, and air-embolism. The latter may be avoided by holding the labia spread apart by the fingers and the instrument, by packing slowly, and having the shoulders of the patient raised. Separation of the edge of a lowly inserted placenta occurred once in the very many cases in which I have thus packed. It was evidenced by a slight flow of pure blood. I put no more gauze into the uterus, but packed the cervix tightly, and the result was good. Rupture of the membranes occurred several times without bad results—indeed, labor seemed hastened. Vaginal tamponade was described under Abortion (*q. v.*).

**Manual Dilatation of the Cervix.**—This is the oldest method of enlarging the

### CERVIX

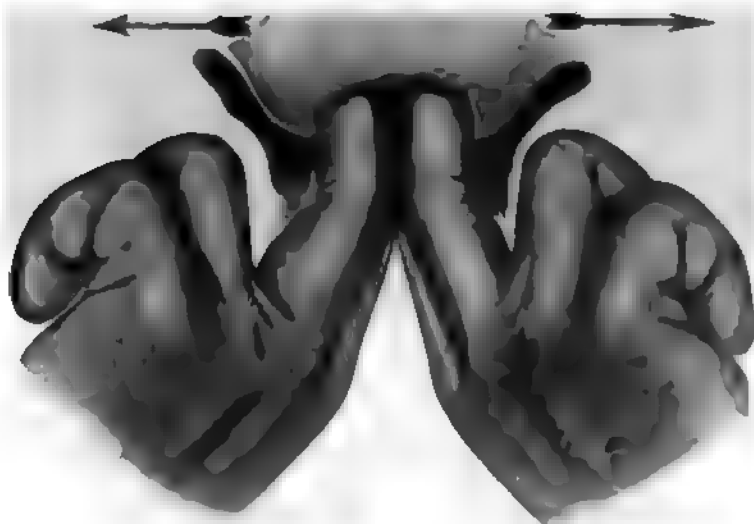


FIG. 794.—DILATING EFFACED CERVIX WITH FINGERS.  
Shows double fulcrum action.

canal, and is spoken of in Hippocrates' writings. It is the method most naturally adopted, but the ancients also possessed pronged instruments operated by screws. Paré, in the forced operative delivery, which he so much practised, and to which his pupil, Guillemeau, gave the name "*accouchement forcé*," began with digital dilatation of the cervix. First one and then two fingers are insinuated through the os. The two fingers may be then spread by one or two fingers of the other hand forced between them like a wedge (Fig. 792). After the tips of four fingers are introduced they are placed back to back, the knuckles acting like a double fulcrum, and the cervical ring is thus expanded. This is similar to the methods devised by Bonnaire and Edgar. P. Harris inserts the whole hand into the vagina, and the cervix is dilated by the insinuation into it of, successively, one finger, the thumb and one finger, then two, then three and four, and finally the hand, the thumb being given a motion of extension, the fingers one of flexion. The only advantage this method has over the others is that the hand, being in the vagina, is not so easily contaminated by feces issuing from the anus, but, by raising the hands toward the pubis in the performance of the operation illustrated above, this danger may be avoided.



It is essential to procure complete opening of the canal, otherwise the delivery of the child which follows may be difficult or impossible, and during the fruitless attempts at extraction the undilated uterus may rupture or the child die or be severely injured. The conditions for manual dilatation of the cervix are: The cervix must be effaced, or very nearly so; the pelvis normal; the child normal in size, and the presentation and position favorable or corrigible. The placenta may not be prævia. The vagina, too, must be dilatable, or is to be enlarged by episiotomy. Unless performed under these conditions, the operation is dangerous and may fail of its purpose. It requires from one-half to three hours, and is often painfully tiring to the fingers and hands. It is invariably attended by lacerations of the cervix, and these tears are often deep, sometimes even of the importance of a rupture of the

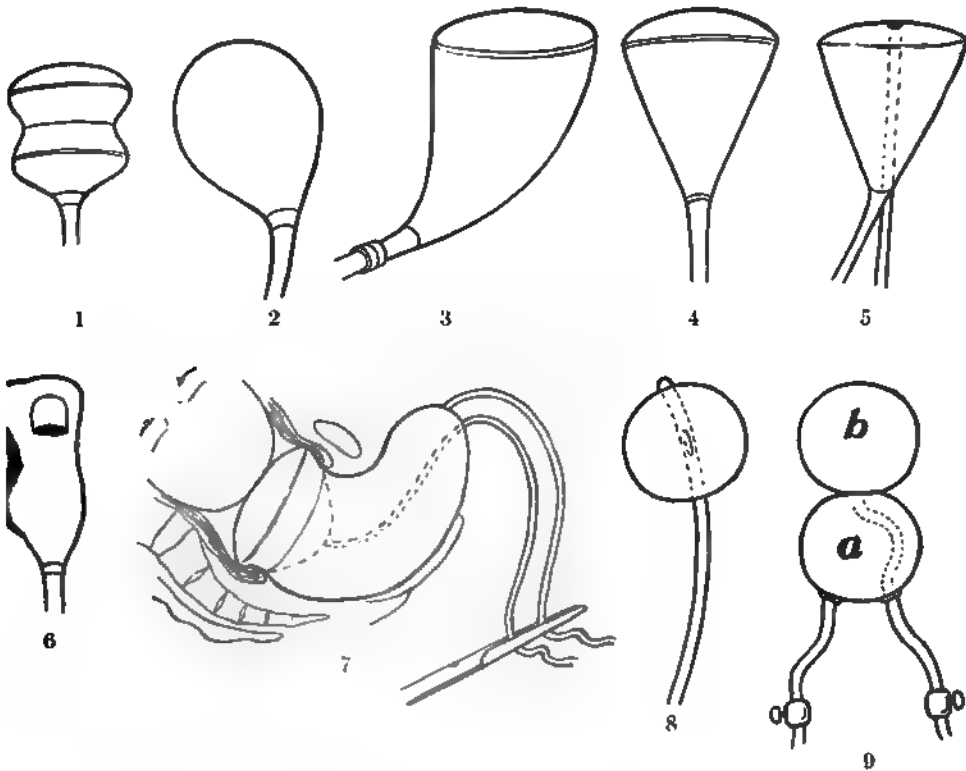


FIG. 795.—VARIOUS BALLOON DILATORS.

1, Hirst's; 2, Braun's; 3, Champetier de Ribes'; 4, Voorhees'; 5, Stowe's; 6, Barnes'; 7, Pomeroy's; 8, Tarnier's; 9, Chassagny's.

uterus, opening the peritoneal cavity, causing death from hemorrhage or from infection. In multiparæ the lacerations are usually somewhat less extensive. In all cases the cervix is bruised and battered, and infection, even in the hands of the cleanest obstetrician, is sometimes unavoidable. In truly exceptional cases the cervix is so soft that it may, within fifteen to thirty minutes, be dilated large enough for safe delivery.

**Metreurytis.—Historic.**—In 1851 Carl Braun invented the colpeurynter, a rubber balloon to be distended with fluid after being placed in the vagina. For a long time previously Chiari, Wellenbergh, and others had used pigs' bladders for this purpose, but discarded them because they decomposed. In 1862 Tarnier invented the "dilatateur intrauterin," a soft-rubber bag or condom on the end of a male catheter. Barnes, in 1862, introduced the soft-rubber fiddle-shaped bags, which are not used any more. In 1888 Champetier de Ribes recommended a large, cone-shaped, inelastic bag, and since then, among the numerous modifications that have been proposed, the use of cloth bags, rendered impermeable by rubber, has already superseded the old colpeurynter of Braun. Schauta, in 1883, published the use of the bag in the uterus, as practised in Spaeth's

clinic. Mäurer, in 1887, introduced constant traction on the bag as a means to hasten its action. In 1907 Stowe invented a bag shaped like the Voorhees bag, but with a tube leading through its center, through which sterile salt solution can be injected into the uterus to replace lost liquor amnii, an idea suggested several years before by Bauer to the Berlin Medical Society. Of all the bags on the market, I have found those of Voorhees, in four sizes, and the large ones of the same shape sold in Europe under the name of Müller, the best, but on some occasions I still use the Carl Braun colpeurynter. Since the bag is usually placed in the uterus, the name hystereum or metreurynter is better. The bags are filled with water and boiled in plain water for thirty minutes, then laid in 1 per cent. lysol solution, with which they are to be filled for application.

The method of application of the hydrostatic bag has been minutely described on p. 471, in the Treatment of Placenta Prævia (*q. v.*). Some operators prefer to pass the bag by sight (Fig. 796), believing that thus it is easier to avoid carrying infection from the vagina into the uterus. The perineum is retracted by a speculum, the cervix is steadied by a ring forceps, and the folded bag is gently insinuated into

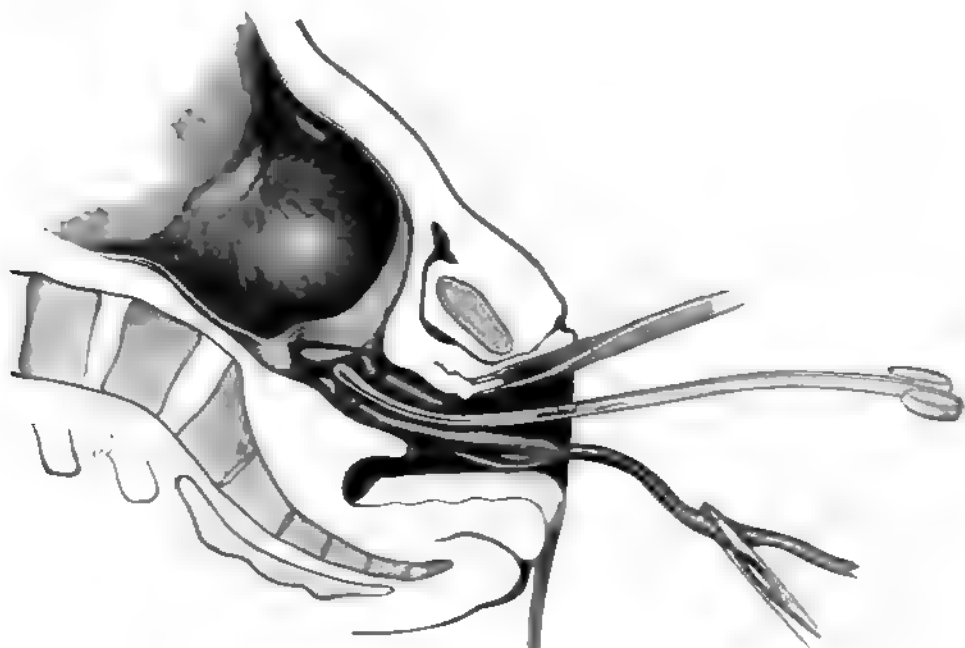


FIG. 796.—PASSING COLPEURYNTER BY SIGHT.

and through the canal, in the direction of one of the sacro-iliac joints, taking due notice of the curves of the canal. Force may not be used, and it is best, in the absence of special indication, to preserve the membranes. Such special indications are eclampsia, in which it has been noticed that the convulsions often cease after the liquor amnii has been let off, polyhydramnion, twins, and other conditions of overfilling of the uterus, and placenta prævia, in order to place the bag on top of the placenta.

If time is no object, traction is not applied, but if the pains are slow in coming, weight of one or two pounds may be attached to the tube. After the first bag is expelled a larger one may be applied, the membranes punctured, or the labor left to nature, depending on the exigencies of the case.

The action of the metreurynter is three-fold: First, it mechanically dilates the cervix from above downward like a fluid wedge, in which respect it closely resembles a bag of waters; second, by its presence and by the dilatation of the uterus which increased volume causes, but particularly by pressure on the retrocervical

**anglion**, the uterus is stimulated to action, and strong pains are usually soon **inaugurated**. Third, it may be used as a tampon, as in cases of placenta prævia, etc. The selection of the bag will depend on the object sought, and if rapid action is desired, the inelastic bag with traction will more quickly evoke pains and dilate the uterus than the soft-rubber colpeurynter, which, under traction, is likely to pull out into a sausage shape and slip through the poorly dilated cervix. If it is simply desired to evoke pains, as in the induction of labor, either bag may be used without traction, or with a minimum amount of it. As a tampon in the vagina, the soft colpeurynter is preferred; in the treatment of placenta prævia, the Voorhees' conic inelastic bag. Early in pregnancy, and in the late months, just to inaugurate uterine action, a small-sized bag is employed.

**Indications.**—Metreurytis is very useful for the induction of premature labor where great urgency is not present, though sometimes, if traction is put on the tube and the parts are not too rigid, the pains start up, and they, together with the mechanical dilatation, open the uterus in a few hours. Whenever there is an indication to hasten delivery in the interests of the mother or child, the bag may be used, and to prepare the cervix or the vagina for rapid delivery, as in breech, shoulder, or face presentation, or in the presence of threatening complications, they are often invaluable. In stenosis of the cervix the bags may be useful, but they require the aid of the pains to soften the parts. A sluggish uterus may be stimulated by the metreurynter, but it is wise to find out the cause of the weak pains—rigidity of the cervix, abnormal adherence of the membranes, overdistention of the uterus, pendulous belly, low placenta—all these may require other treatment. In cases of dry labor the bags deserve more general application, since they replace the bag of waters to a considerable extent. In shoulder presentation, to preserve what is left of the liquor amnii and to keep the presenting part from impaction in the pelvis, the metreurynter should be applied and complete dilatation awaited. In contracted pelvis, where spontaneous delivery is to be expected, a bag is to be applied if the membranes rupture prematurely. Generally speaking, metreurytis is useful when the bag of waters ruptures before complete dilatation has been effected. In prolapse of the cord the hysteurynter is of great value. Perhaps the most valuable function of the metreurynter is as a plug in cases of placenta prævia. While properly not belonging here, it may be mentioned that the colpeurynter is useful,—placed in the vagina, to prepare the vagina and pelvic floor for rapid delivery, as in breech presentation, forceps, version, and extraction; to overcome rigidity of the soft parts; to stimulate pains; and, during pregnancy, to lift up a retroflexed uterus, to raise a uterus that may be causing hyperemesis, and in the treatment of pyelo-ureteritis.

**Conditions.**—The cervix must be open enough to insert the size of bag desired. Rarely is it necessary to use metal dilators first. Packing the cervix with gauze for twelve hours usually suffices to render it soft and dilatable. Cervical carcinoma and threatened uterine rupture contraindicate the operation. In the presence of vaginal infection some other plan should be selected, if possible, such as puncture of membranes, vaginal cesarean section, even the Porro operation.

**Dangers and Disadvantages.**—In a few cases the uterus does not respond, the bag is not expelled, and traction, within the limits of safety, does not open the cervix. Sometimes traction brings one bag after another through, but the uterine action does not come into play and the cervix closes up again. Several cases are recorded where pregnancy continued. Oftener the repeated manipulations, which in some cases may extend over a period of five or more days, causes fever (infection), and then, unless the pains come on strongly, a formidable condition is presented for treatment. Such torpor of the uterus is rare.

The metreurynter may displace the presenting part, and this may be undesirable, unless version is in contemplation. Prolapse of the cord is a real danger. In spite of close watching and care this happened in two of my cases, and



sequent extraction of the child to prevent the lacerations from extending—an accident which has happened in the hands of the world's best accoucheurs. The preparations for the operation are the same as for any major obstetric procedure, because sometimes a severe hemorrhage must be faced, and afterward the wounds are to be repaired. The indications are found in those complications bringing danger to mother or child, when the cervix is obliterated, only the thin partition between the dilated lower uterine segment and the vagina being left to overcome. It is a common operation before the application of forceps in occipitoposterior positions in primiparæ, or in other operative deliveries when the cervix is not open enough. Rigid cervix scars, conglutination, etc., are occasional indications. The condition which must be insisted on is *complete effacement of the cervix*. Placenta

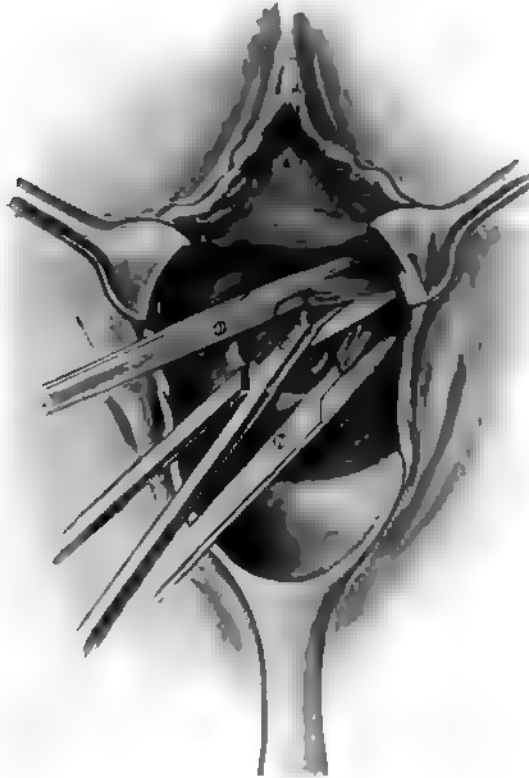


FIG. 798.—DÖRRSEN'S INCISIONS.

Under wide exposure of the field by broad specula the cervix is grasped and cut between two eight-inch forceps, which are left on a few minutes to stop hemorrhage.

prævia is a contraindication. Most so-called manual and instrumental dilatations of the cervix are in reality bilateral incisions or tears, but made with blunt instruments.

**Accouchement Forcé.**—This operation was introduced by Paré, given the name by Guillemeau, his pupil, but, owing to its great maternal (sepsis and hemorrhage) and fetal (asphyxia) mortality, was employed only in the gravest emergencies. Under the protection of asepsis and antisepsis it was revived, but is now rapidly falling into disuse because of the almost invariable severe injuries inflicted on the mother, the frequent hemorrhage and deaths caused, and the paucity of fetal lives saved. The original conception of the operation was rapid dilatation of the cervix by the hands, version, and forced extraction of the child. Recently the term has been used to apply to any one of several methods of rapid delivery from below.

While admitting that a few cases occur where it is not extra-hazardous to dilate the cervix and extract, according to the original formula, these are so few and the dangers of the others so great that the author would advise dropping both the term and the operation altogether from our obstetric surgery, a condition which, to judge from present obstetric literature, will soon be present. As a substitute for the brutal and unsurgical operation the metreurynter, in cases of not great urgency, and vaginal or abdominal cesarean section in the others, are suggested.

Mention may be made, for the sake of condemning the procedure, of the operation of using the body of the child as a dilator of the parturient canal. Unless the infant is dead, and excepting a few cases of placenta prævia, such a method is inadvisable.

Vaginal cesarean section, or colpohysterotomy, is an operation devised by A. Dührssen, of Berlin, April 1, 1895. Acconci, of Italy, devised a similar operation.

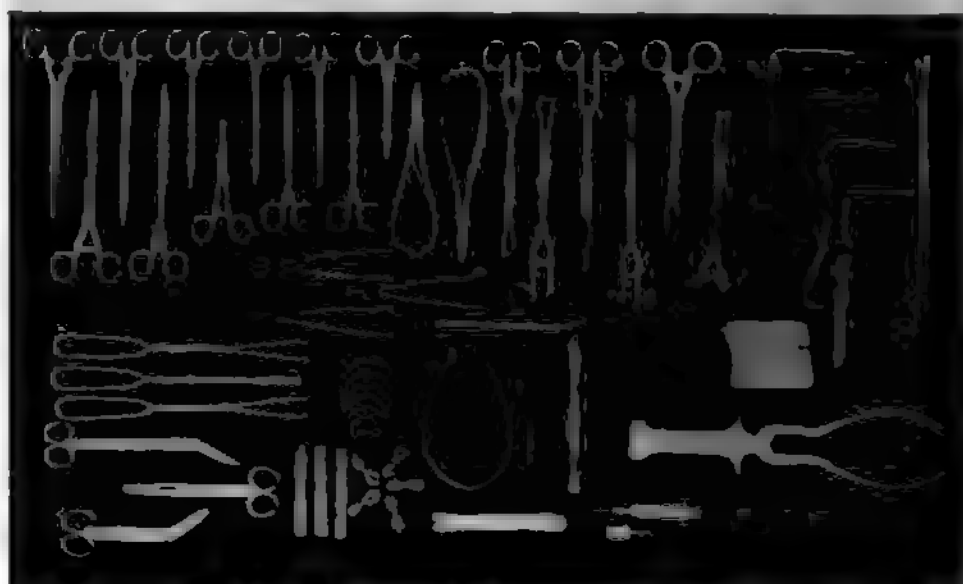


FIG. 7. INSTRUMENTS FOR VAGINAL CÆSAREAN SECTION.

Short broad sperrin, 3 rows, also 1 long narrow scalpel, 3 scissors, 1 of which is long, 4 s-cure, one 4- and 6-rib artery clamps, 1 ring, 2 double vulsellum, and 2 bullet forceps, 3 dissecting forceps, long and short needle-holder, 4 needles, silk-worm gut and catgut suture, curved packing forceps, silver female catheter, glass for packing, short forceps, tracheal catheter, if vaginal hysterectomy is to follow, add 2 Deschamps needles and double the number of long artery clamps.

but Dührssen ("Der vaginale Kaiserschnitt," Berlin, 1904) conclusively proves its priority. The term vaginal cesarean section, used in the eighteenth century for cervical incisions, was considered by Baudeloque unsuitable. Although Dührssen's operation is a formidable one, deserving the name he chose for it, the terms vaginal hysterotomy or colpohysterotomy might supplant it.

**Precautions.**—These are the same as for any major obstetric operation. An anæsthetist, two assistants, and a nurse are needed if good work is to be done.

A table, the lithotomy position, and good horizontal light are essential. The operation has been successfully done under the auspices of practice in a home, but with increased without difficulties.

**The Operation.**—If the parturient is close to the end of pregnancy and primipara, it is best to make a deep unilateral episiotomy—on that side to which the occiput presents—so as to be used in the operative delivery, if necessary to be performed. This will prevent lacerations to perineum during the subsequent delivery. If the episiotomy would bleed too freely, it may be sewn up temporarily, the line of suture being at a right angle to the line of incision. Dührssen inserted a finger into the vagina to see the child is at full term, or making both anterior and posterior cervical incisions. Bland made the anterior incision, if extended, gives sufficient space. My experience accords with Dührssen's. The cervix must be in the median line. It is often turned by

rotating presenting part to one or the other side. Fig. 800 shows the field exposed by short and specula, the cervix drawn by vulsellum forceps or by silk traction ligatures, and red lines to indicate the location of the incisions, which go through the mucous membrane of the vagina only. After the vagina has been reflected off the base of the bladder, the latter is pushed upward, off the anterior cervical wall (Fig. 801), using the finger covered with gauze. At the same time

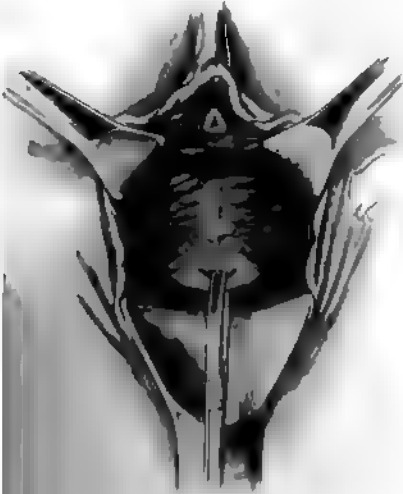


FIG. 800.—VAGINAL CESAREAN SECTION.  
Measure of field and line of incisions. The anterior cut begins one inch from urethra.



FIG. 801.—POSSING THE BLADDER OFF THE CERVICAL WALL.  
The finger is covered with gauze.

The cervix is partly freed from the bases of the broad ligaments at the sides, but care is required as large veins may be encountered. Now the cervix is grasped by two vulsellum forceps and split medially (Fig. 802) up to the internal os. Fig. 803 shows this section made and the bag of waters pouching in the opening. Operating again as in Fig. 801, the bladder is stripped further off the anterior wall, laying it bare to view, and the uterovesical fold of peritoneum can be seen or



FIG. 802.—SPLITTING THE CERVIX.

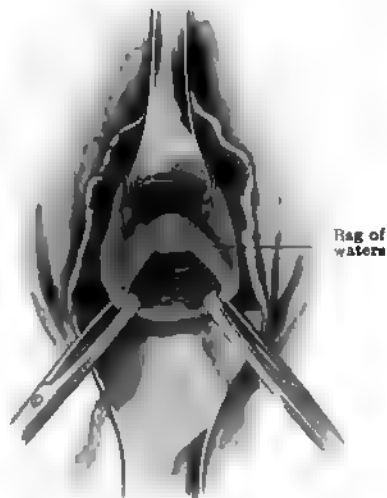


FIG. 803.—CERVIX SPLIT TO ABOVE INTERNAL OS.

at the upper end of the wound. A narrow speculum is inserted to expose the field clearly. Now the medial uterine incision is continued upward (Fig. 804), the vulsellum forceps being placed successively higher portions of the cervix and lower uterine segment, and pulling them down into a bite of the scissors. Care is to be exercised to keep in the median line and to avoid injuring the peritoneum. This is pushed off the lower uterine segment before the advancing scissors by means of the finger.

For a child weighing about 3 or 3½ pounds, an anterior incision 10 cm. in length will suffice. One may test the size of the opening by passing through it the fist, made about the size of the baby's head, by holding in it a large ball of cotton. If more space is needed, the an-

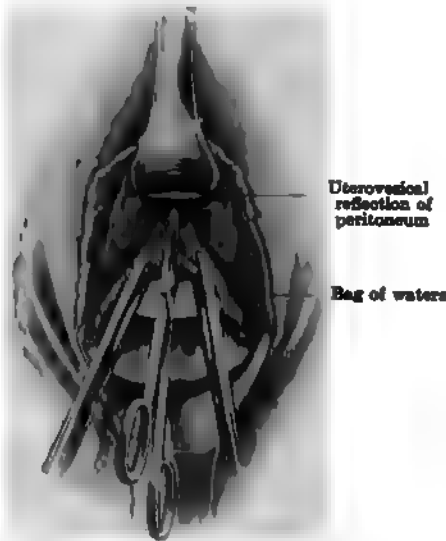


FIG. 804.—INCISING LOWER UTERINE SEGMENT.

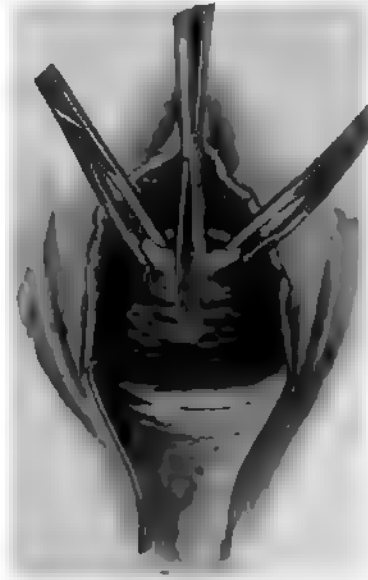


FIG. 805.—INCISING POSTERIOR WALL.

terior incision may be extended upward or the posterior wall may be incised also (Fig. 805). Dilsen makes the posterior cut first as routine.

Grasping the cervix with bullet forceps, it is split to the vaginal reflection, then the peritoneum of Douglas' culdeas is pushed upward and loosened at the sides, after which the low-



FIG. 806.—SUTURING ANTERIOR INCISION.



FIG. 806a.—VAGINAL CESAAREAN SECTION. HAVING FIRST INSERTED A VOORSKEEL BAG.

By pulling on the bag the cervix becomes accessible, and as soon as enough room has been obtained the bag comes through.

terine segment is divided as high as needful. Delivery is now accomplished by forceps or by traction and extraction, according to preference—I prefer forceps. If labor pains are present



hemorrhage is not usually profuse, but if it is, manual removal of the placenta and uterine tamponade are rapidly performed, and ergot given hypodermically, or pituitrin injected into the cut edges of the uterine muscle. A careful examination of the parturient tract is made to determine the extent of the wounds. Now the wounds are sutured (Fig. 806). By traction on the silk loops or vulsella, placed on the uterine edges, the uppermost angle of the wound is readily drawn into view, which may be aided by a narrow speculum placed so as to retract the bladder. A continuous suture of No. 2 plain catgut, taking in the mucosa and part of the muscle, is rapidly put in, care being observed not to include the uterine packing, and over this a second layer is placed, after which the vagina is closed with a running suture of chromic gut. A strip of gauze may be left to drain the large subperitoneal wound for twenty-four hours. If the posterior wall has been divided, this is sutured first, with a running through-and-through catgut suture, tied on the interior of the cervix. Finally, the perineum is repaired. The operation requires from eight to twenty minutes for the delivery of the child, and from twenty to forty minutes to repair the incisions. If, as with cancer, the uterus is to be extirpated, the anterior and posterior incisions are prolonged until the uterus is bisected, and the broad ligaments are clamped and tied, each half being removed after the method of P. Müller.

**Dangers.**—Injury of the bladder and ureters may be avoided by proper technic, by going slowly without attempts at spectacular operating. In pushing the bladder off the cervix it must be borne in mind that, as labor progresses, the bladder is drawn up, and usually to the right side.

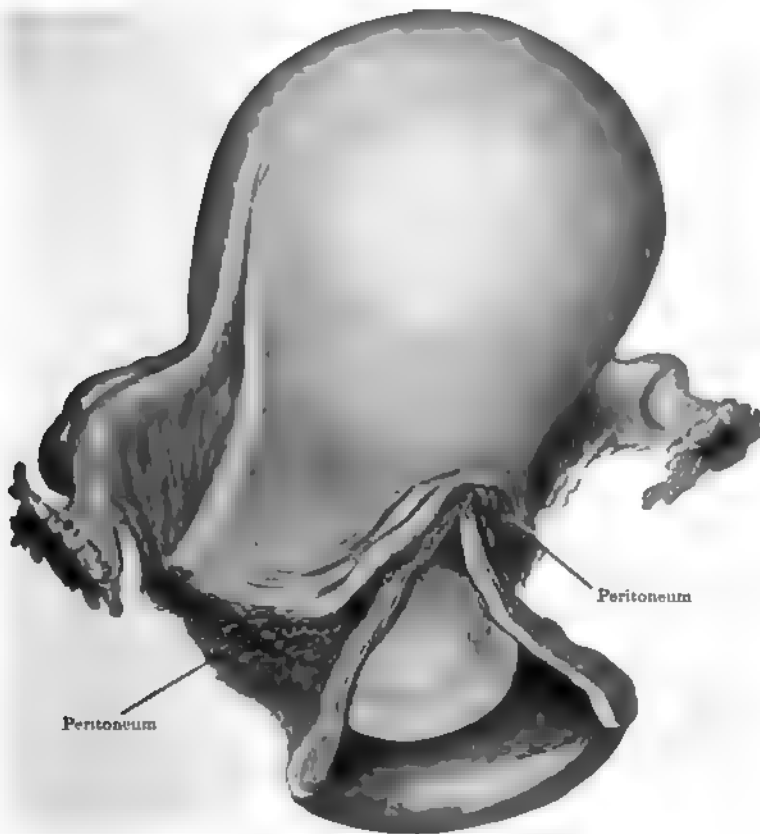


FIG. 807.—ANTERIOR VIEW OF OPERATION.

In breech and shoulder presentations the bladder is more central. One of my cases whose operation was entirely uncomplicated returned after six years with a displaced and knicked left ureter which causes intermittent hydronephrosis. Hemorrhage is usually not marked if the uterus is divided cleanly in the middle line, if the tissues at the side are spared, and the cuts do not tear further, which they will not do if properly placed at first. In one case the tissues were so friable that the traction ligatures and vulsella pulled out, and hemorrhage was so profuse that the vaginal route had to be abandoned. After the delivery, packing the uterus will stop hemorrhage. Pulling down the uterus strongly also has a good influence. There is no reason why Momburg's constrictor may not be applied if needed at this stage. In one case the broad ligaments and pelvic connective tissue were so edematous that the cervix could not be drawn down for incision, and abdominal cesarean section was indicated. To gain access to the cervix when it is high up Dührssen advised a deep paravaginal perineal incision, or deep episiotomy, and also lately, what seems to

be a real improvement in this operation, the metureurynter, by means of which the cervix is pulled down and on which it is incised. When the fully distended colpeurynter can come through the incision, the child can be easily delivered. Should the bladder be opened, it is to be sutured after delivery and a permanent catheter inserted. If the peritoneum is torn, it is sutured at once. In both instances drainage from below is indicated. Rupture of the vagina occurred in two of my cases, threatening hemorrhage from the bases of the broad ligaments in three.

Subsequent pregnancies and labor in three of my cases were entirely uneventful, and many such are reported, so that there need be but little fear that the uterus will rupture, but in several instances the wound did not heal perfectly, leaving an everted eroded cervix.

**Indications.**—When the cervix is closed and an indication arises for rapid delivery, and, second, when the cervix is diseased and nature is unable to overcome the obstruction, vaginal cesarean section may be done. Under the first caption may be placed eclampsia, abruptio placentæ, hyperemesis gravidarum, uncompensated heart disease, lung disease, œdema pulmonum, asphyxia in utero—in short, all acute complications on the part of the mother or infant. Under the head of obstructions cancer, stenosis, antefixatio uteri, scars from old operations, may be mentioned.

**Conditions.**—Delivery from below must be possible, that is, the pelvis must be large enough and presentation and position of the child favorable. Although some authors recommend the operation in placenta prævia, I would consider this a contra-indication, and Bumm recently retracted his recommendation. The child must be living, unless the indication for haste on the part of the mother is imperative. The operation simply overcomes the resistance of the cervix, and it is highly important to determine beforehand if there is an edema of the connective tissue or excessive friability of the tissues. In 45 operations performed by the author many technical difficulties were encountered. It is, therefore, not to be undertaken except by one skilled in pelvic surgery.

**Operations Preparing the Vagina and Pelvic Floor for Delivery.**—Episiotomy and the deep paravaginal incisions have already been described, and it has also been said that the colpeurynter may be placed in the vagina to prepare it for the subsequent delivery. This procedure is especially useful in breech and shoulder presentations in primiparæ. Some authors advise manual dilatation of the pelvic floor and vulva preparatory to forceps operation or other rapid operative delivery, and before hebstectomy. My own experience proves to me that in such cases we do not really stretch the muscle and leave its structure perfect afterward, but we cause innumerable, minute or larger, submucous tears, and afterward the women return, not with torn pelvic floors, but with relaxed pelvic floors, the functional result, however, being the same or worse. I prefer a clean cut to these unsurgical methods, and am convinced that the after-effects are much more favorable. Unfortunately, this ideal practice comes into conflict with the desire to avoid the necessity of "putting in stitches," which carries a certain opprobrium among the women. I know that many children have been lost and much invalidism has resulted from this ill-advised and objectionable sentiment.

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## CHAPTER LXX

### PREPARATORY OPERATIONS (CONTINUED).—PREPARATION OF THE BONY PELVIS

**Enlarging the Pelvic Canal.**—Reference has already been made to the idea of the ancients that the bones of the pelvis soften and separate during delivery. We make use of the softening of the joints and the movability of the bones on each other to produce, by posture, actual enlargement of the diameters of the canal. Thus it is certain that the Walcher position enlarges the *conjugata vera*, and the exaggerated lithotomy, the bony outlet, particularly in its transverse diameter. The idea of cutting the bony pelvic ring is not recent.

**Symphysiotomy and Hebosteotomy.**—Pinæus, in 1570, refers to section of the pelvic bones; *de la Courvee*, in 1655, delivered a child by section of the symphysis pubis after the mother died in labor; Sigault, in 1768, invented the operation of symphysiotomy, but could not perform it until 1777. The woman, *Mme. Souchot*, and her child, survived, but she had a permanent vesicovaginal fistula, fecal incontinence, and difficulty of locomotion. Sigault was given a silver medal. In 1775 Aitken recommended section of the bones on both sides of the joint by means of an articulated saw, but never did it on a live woman; in 1821 *Champion de Bar le Duc* pointed out the advantages of cutting the bone instead of the symphysis, and in 1830 Stoltz, of Strassburg, perfected the operation of pubiotomy, using a chain-saw, very much as it is done today, but he also operated only on cadavers. In 1832 Galbiati tried Aitken's recommendation, but the mother and babe died from the operation itself, and pubiotomy all but disappeared until Gigli, of Florence, in 1894, drew general attention to the operation and published his saw,—a roughened steel wire,—which he had invented for the express purpose of cutting the pelvic girdle. Bonardi, in 1897, performed the first operation with the saw, Gigli operating in 1902 the first time on the living. Symphysiotomy had a checkered career. In France an acrid polemic was waged about it, and Baudelocque, Caseaux, DuBois, and La Chapelle finally caused its abandonment. In Germany and England the operation never obtained a foothold, but in Italy, in spite of its high mortality and morbidity, it enjoyed a sporadic existence by grace of Galbiati and Morisani. With the improvement in asepsis and instrumentarium of the late eighties and the proper selection of cases naturally the results improved. In 1891 Spinelli, a pupil of Morisani, went to Paris, interested Pinard in the revived operation, and the latter, within a year, performed it 17 times. In 1892 and 1893 it was being done in all countries with the overenthusiasm begotten by every new remedy, and for a time symphysiotomy threatened the firm position held by cesarean section. Toward the end of the last century, however, it lost ground almost entirely. Zweifel, in Leipsic, Kerr, of Glasgow, and Pinard, in Paris, are among its few fast friends even today.

In 1904, as the result of the publications of Gigli, Van de Velde, and Döderlein, pubiotomy took the center of the stage, and in the subsequent five years hundreds of operations were performed the world over. Now the enthusiasm is waning, because it has been found that the operation has an unavoidable maternal and fetal mortality and a considerable morbidity. While Stoetzel says pubiotomy has about disappeared from Europe, Williams, of Baltimore, recommends it highly. The advantages of pubiotomy over symphysiotomy have already been considered (p. 36), as also have the indications and the time of performance (*q. v.*).

**Anatomy.**—Figs. 808 and 809 show the anatomy of the field of operation. The large venous plexuses are the source of the profuse hemorrhage. It is easily seen how the triangular ligament,—the urogenital septum,—robbed of its anterior support, is always torn, exposing the urethra, the vaginal vagina, and the vestibular structures to serious injury.

**Symphysiotomy.**—There are several methods of opening the pubic joint, some exposing the field, others subcutaneous. Italian operators make a small incision above the pubis, and, under the guidance of the finger, pass a curved, ball-pointed knife around the joint, severing the cartilage from below upward. Farabeuf makes a long incision over the joint, cuts the *ligamentum suspensorium clitoridis*, reflects the latter downward, passes a grooved director around the joint, and cuts down on it from before backward. In my cases I made a two-inch incision over the upper half of the pubis, then, by strong traction, pulled the opening down over the whole joint, which was thus exposed; then the bone was divided from above downward to the *ligamentum arcuatum*, which was severed only if necessary. In this way the wound was high up, away from the flow of the lochia. After delivery the bones are pressed together, and three catgut sutures passed through the deep structures over

**Hebosteotomy.**—Gigli's original operation was an open dissection, and the results were no better than with symphysiotomy. Walcher devised a method of operating directly subcutaneously, which Bumm has simplified. Döderlein, before Walcher, modified the operation of Gigli, and his is the one usually recommended.

**Döderlein's Operation.**—Preparations are made for a serious operation, although it is usually one. In rare cases hemorrhage and lacerations occur which tax the skill of the most expert. Fig. 810 shows the instruments needed. Two trays are to be used—one for instruments for the work on the joint and the other for the vaginal work. If it is necessary to return to the wound the joint after the hands have had to do with the parturient canal, the operator should draw on another pair of sterile gloves.

The patient is put in the posture for delivery shown in Fig. 783, but the legs are held by the

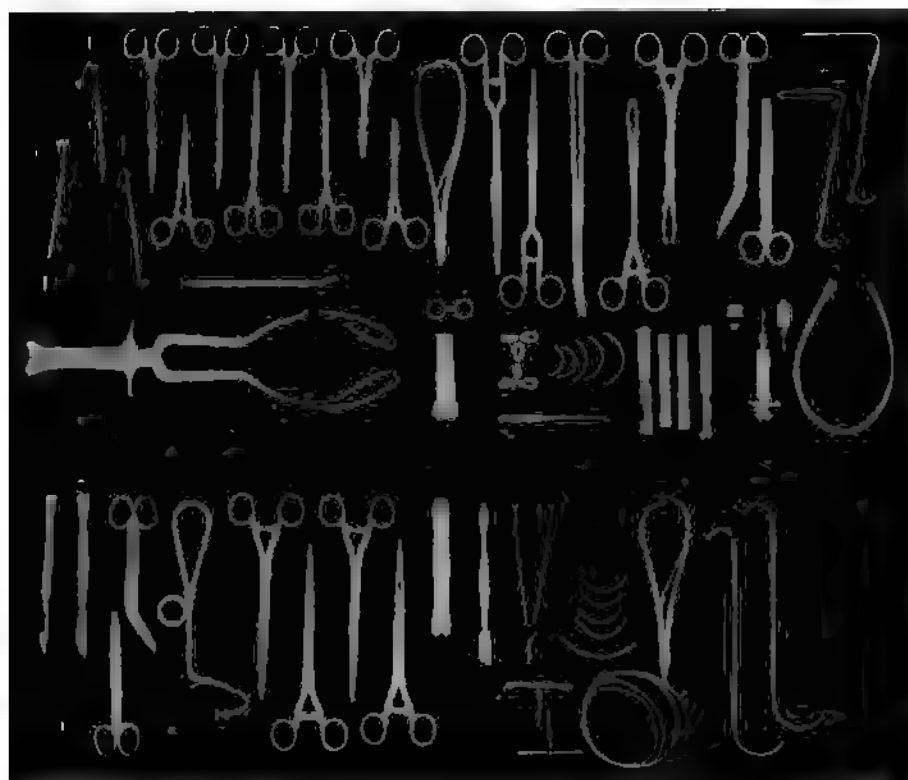


FIG. 810.—INSTRUMENTS FOR HEBOSTEOTOMY.

Lower tier is for the operative wound, and the instruments are kept separate from the others, which are used for delivery.

**Pubic Tray:** 2 scalpels; 4 artery forceps, 4 8-inch clamps, 3 Gigli saws; 1 pair handles; 1 needle; 4 small needles; 2 retractor forceps; 2 retractors; 2 scissors; flat spatula; 1 raspatorium; silk-worm-gut, etc.

**Vaginal Tray:** Obstetric forceps; 3 scissors, 6 artery forceps; 2 ring forceps, 2 vulsellum forceps; 3 tissue forceps; 2 fine packing forceps; 2 needle-holders, 6 needles, 3 specula; tracheal catheter, version sling and carrier, salt solution needle, etc.

Two assistants nearly horizontally. A transverse or longitudinal incision, one inch long, is made at the left pubic tubercle, down to the rectus fascia and through it, but the latter cut is always made longitudinally, and only large enough to permit the finger to pass behind the pubis. This finger gently separates the bladder and fat from the bone, until the ligamentum arcuatum is felt. With the needle (Fig. 811), armed with a silk ligature, is guided by the finger around the bone, the point of the needle adhering as closely to the bone as possible. When the point has rounded the ligamentum arcuatum, it is bent sharply forward, while an assistant pulls the labium toward the right side—this to bring the opening in the skin far from the flow of the lochia, and, by the sliding of the tissues, to close the passage of the needle. A nick with the knife allows the tip of the dull needle to emerge; the thread is grasped and the needle withdrawn. The saw is pulled through by means of this thread, and the saw handles attached. By to-and-fro motions of the saw, the motion resembling cutting a bar of soap with a string, and making short strokes, the bone is severed. In this motion the saw may not be sharply bent. Mayer advises to place the patient in the Walcher position while sawing the bone, and raise the limbs gradually, to prevent too sudden separation.

tion of the two halves of the pelvis and injury to the soft parts between. Costa does the same, and Kerr uses the Walcher for the delivery.

Hemorrhage is usually free from both wounds, during and just after the bone is sawn through. Quickly the upper wound is packed with hot iodoform gauze, a stitch of silkworm-gut closed.

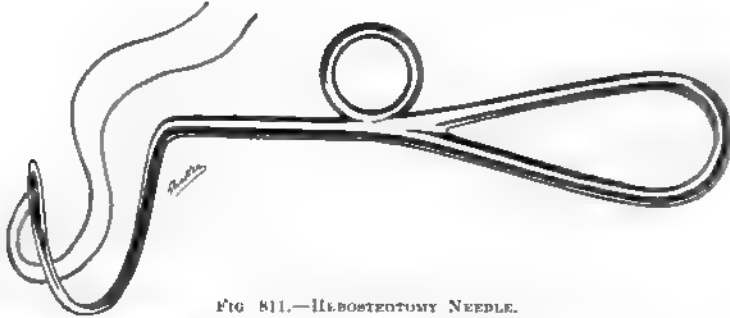


FIG. 811.—HIBOSTECTOMY NEEDLE.



FIG. 812.—HIBOSTECTOMY. PASSING THE NEEDLE. GIGLI SAW AT RIGHT.

lower puncture, and an assistant makes counterpressure from the vaginal surface by means of a large gauze swab. In a few minutes the hemorrhage has usually ceased, the gauze may be removed, and the pubic wound sewed up with three deep silkworm-gut sutures. The bones separate with a very unpleasant at first about 2 cm. and during extraction is very unpleasant. The bones separate and the enlargers the sacro-iliac joints. After the needle is placed the bladder is to be catheterized to test its integrity, which, being assured, the operation is proceeded with.

Some operators leave the delivery to nature or wait for later indication, especially in primiparae, but by the majority immediate delivery is practised. In primiparae I prefer to leave the delivery to nature, as does Stoeckel also.

Version is generally not advised. The head may be pressed into the inlet from above, or a few pains awaited and then the forceps applied. In primiparae a deep episiotomy should always be made before applying the instrument, and in multiparae also if the introitus is small. The danger now to be avoided is rupture of the anterior vaginal, urethral, and bladder-wall, hence the extraction of the child must be very deliberate and the direction of traction be downward, to relax the anterior wall as much as possible. During the delivery the assistants press the pelvis together from the sides, but I believe Kerr's suggestion to use the Walcher position is better. It is highly important that the mechanism of labor be favorable—a posterior occiput or a brow presentation, therefore, should be corrected previous to extraction. It is my practice to remove



FIG. 813.—HEBORTOTOMY. SAW IN POSITION.

the placenta very soon and pack the uterovaginal tract with gauze as a routine. Now all vaginal injuries are repaired, a clean pair of gloves put on, and the pubic wound inspected and treated, if necessary. Catheterization of the bladder now determines if this organ is injured.

**Subcutaneous Operation.**—Bunn uses a sharp, full-curved needle and passes it from below upward under the guidance of a finger in the vagina (Fig. 814). It is threaded with the saw, then withdrawn, and the operation completed as above.

**Complications.**—Hemorrhage is easiest to control in the open symphysiotomy when clamps may be placed on the crura clitoridis and bleeding veins, but in one case I had to pack the vagina tightly and place a sand-bag on the pubis to exert counterpressure. In subcutaneous operations compression from within and without for five to fifteen minutes almost always stops the hemorrhage, but if it does not, delivery must be effected at once, the uterovaginal tract firmly plugged, and then counterpressure from without provided. If this fails, which is very unusual, a deep suture may

be ankylosed, as by tubercular disease, advanced age, etc. (2) The child must not be too large, especially in primiparæ; (3) the child must be in good condition and not deformed, for example, hydrocephalus, anencephalus; (4) the maternal soft parts may not be infantile nor rigid, hence hebosteotomy should seldom be attempted in primiparæ, especially if very young or old; (5) the mother must be in good condition and not infected, that is, no fever, slow pulse, clean conduct of labor; (6) the cervix must be effaced and dilated; (7) the woman must be in a well-equipped obstetric operating-room, with plenty of assistants, since the operation is one to be done in the home.

*Prognosis.*—The reader is referred to p. 738. Recently reports by Williams and Toeckel show series of 38 and 24 cases respectively without maternal death,

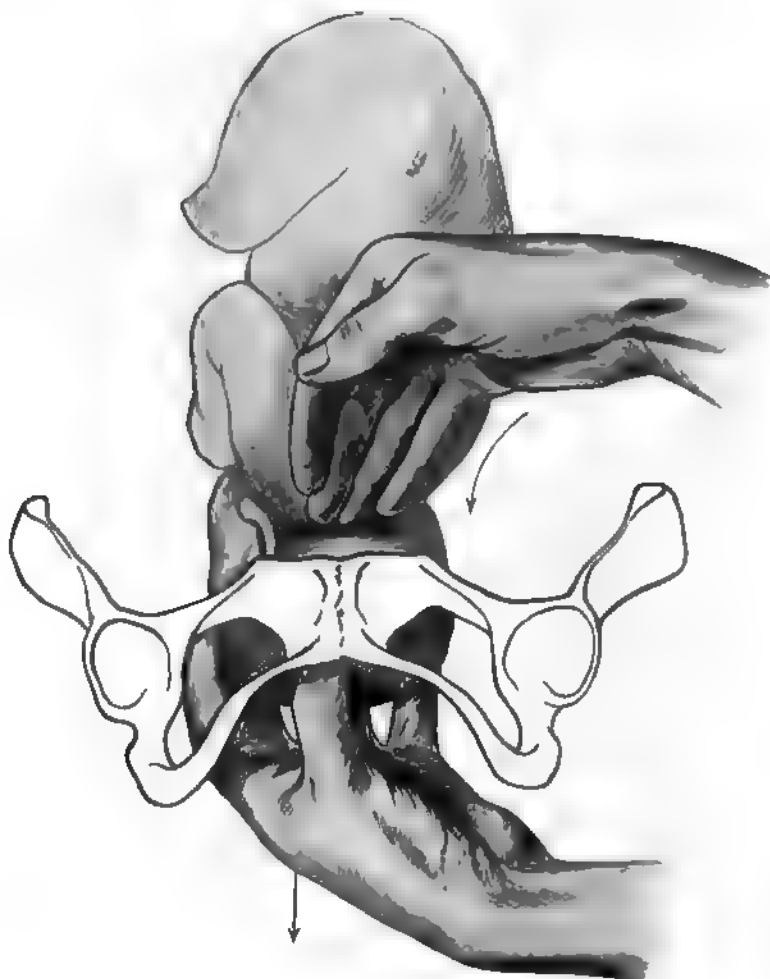


FIG. 818.—LEADING HEAD INTO PELVIS BY COMBINED PRESSURE AND TRACTION.

8 and 4 per cent. fetal deaths, the late results being good. Locomotion is compromised, though tenderness and pain were noted several times. After symphysiotomy there is often a slight permanent enlargement of the pelvis, but subsequent deliveries may be spontaneous, but after hebosteotomy this is not marked. Union of the bones by a strong fibrous callus is the rule, but in some cases, especially after eight months, it is bony. Plastic operations on the symphysis have been suggested for the permanent enlargement of the pelvis by Smith, Credé, Groves, and others, but they are irrational and impractical.

all behind the baby's ear, and seek to pull the occiput downward and forward, while the other hand, outside, pushes the forehead toward the back part of the pelvis. When the head is in proper position, an assistant, working from the outside, holds the forehead at the point to which the operator pushed it, while the latter uses his other hand to insert one blade of the forceps. The other hand, which has been kept aside to prevent the occiput from rolling backward again, guides the forceps blade to place. In many cases I have retained the occiput in its new position by means of a vulsellum forceps while the forceps were being adjusted. If the head is not engaged, a more complicated operation is required. Eden and Kerr record very successful manipulations. The following procedure has been practised by the author for many years (Fig. 817, p. 954). Under deep anesthesia the whole abdomen is passed into the uterus, pushing the head up and out of the pelvis if necessary. That hand is selected which will have its palm directed toward the face

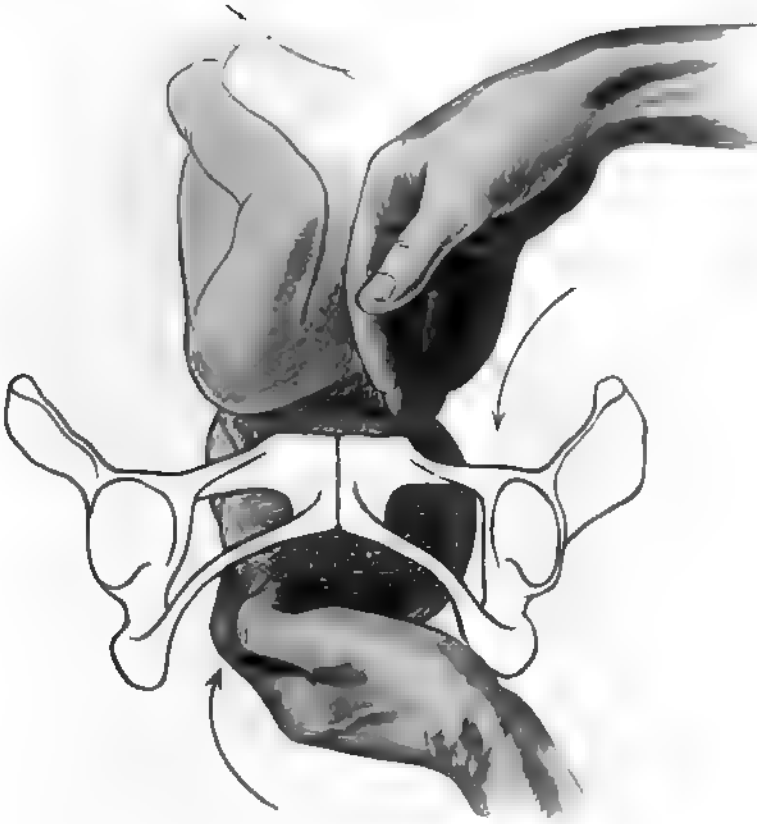


FIG. 820.—CHANGING FACE TO OCCIPITAL. SECOND MOVEMENT.

The fingers of the inside hand push up the face, the thumb trying to push down the occiput, while the outside hand forces the occiput down too.

the infant. The posterior shoulder of the child is sought, and with the tips of the fingers is swung around to the front, past the promontory of the sacrum. The head fitting into the palm of the hand goes with the trunk. The hand outside aids the motion by pulling the shoulder toward the front. When the inside hand is drawing the head into the pelvis in its new position, the outside hand forces the head down by pressure on the occiput, which is now over the pubic ramus (Fig. 818, p. 956). It may be advisable to draw the head down deep into the pelvis with forceps, await four to six labor-pains, remove the forceps, and leave the case to nature, to follow a later indication. The latter plan is especially successful in primiparae, because the molding of the head and the softening of the tissues produced by



a few hours' labor and the progress of the head toward the outlet immense facilitate the subsequent delivery.

The conditions for this operation are: (1) The pelvis may not be too contracted for the subsequent delivery; (2) the child must be living; (3) the cervix dilated to admit the hand; (4) the bag of waters ruptured; (5) the uterus must be in tetanic contraction or on the point of rupturing; (6) placenta præviola or prolapse of the cord may not exist. In rare instances the manipulation must be given up because the force required is too much to be safely applied; the forceps alone will be able to effect delivery, but the operator must be aware that they are very difficult to apply under such conditions and invariably



FIG. 821.—CHANGING FACE TO OCCIPITAL. THIRD MOVEMENT.—The fingers now push the child's chest toward the side, the thumb at the same time forcing the occiput down; the other hand presses the breech over, to flex the trunk.

serious and deep injuries to the maternal parts. If the operation is successful, the child is born frequently results.

**Improving the Attitude of the Child.**—Faulty attitudes, face, brow, and presentations, prolapse of extremities and of the cord, with indications of fetal distress, have already been considered (p. 601). It remains to show how these presentations may be corrected.

**Acute retractor.**—Recommended to push up the chin and face, and then to pull the occiput down and pull this down into the pelvis—all being done

side hand. Schatz (1872) sought to alter the posture of the head by changing extension of the trunk to flexion. In face presentation the usual C shape of child's spinal column is changed to resemble the letter S, and Schatz, operating on the outside, by pulling the shoulder in one direction while he pushed the breech in the opposite, in favorable cases could alter the attitude of the trunk so that the head went over from a condition of extension into one of flexion. Thorn (1893) combined both methods, and was more successful than Schatz in breaking the curves of the fetal body and producing the C shape (Fig. 819, p. 956).

My own method, which has failed only once in twelve cases of face presentation,



FIG. 822.—CHANGING FACE TO OCCIPITAL. FOURTH MOVEMENT.  
Leading the child downward into engagement.

and once in three cases of brow presentation where it was attempted, is similar to Schatz's, but more is done by the inside hand.

**Author's Method.**—A good table, the obstetric position, with the nates well over the edge will allow the operator to sink his elbow, and deep anesthesia are indispensable. The operation consists of four acts—first, raising and releasing the head and shoulder from the grasp of the uterus, so that the baby floats free above the inlet; second, flexion of the chin and forcing down the occiput; third, pushing in the prominent convexity of the chest to a concavity; fourth, leading the now flexed head into the pelvis.

at the time of Christ, Soranus, one hundred years after, and Aëtius (sixth century A.D.) termed podalic version, but this knowledge was lost in the dark ages, until Ambroise Paré, 1560, described and very successfully performed the operation. Wiegand, in 1807, introduced manual version, but the procedure had been previously used in Japan and Mexico as an empiric measure during pregnancy to favor labor, and by Pechey in England as early as 1698. Hohl, 1845, Wright, of Cincinnati, in 1854, and Braxton Hicks, in 1860, perfected the combined methods of version.

**Version in Transverse Presentation.**—If recognized during pregnancy, the transverse position of the child may be changed by the woman assuming, when in a posture which favors descent of the head—that is, she should lie on that side which the head lies. The breech then falls over to the side, the head sliding over the inlet. In spite of a snugly fitting binder the child may not remain in the new position. Even during the first stage of labor postural treatment is to be tried, here external cephalic version is the operation of choice if operation is needed.



FIG. 823.—WIEGAND'S EXTERNAL VERSION.

Questionably, cephalic presentation is the most favorable for mother and child, the woman should try to bring the head into the inlet by external cephalic version, but, however, by the following conditions: (1) There should be no contraindications of the pelvis unless pubiotomy is in anticipation, and the child may not be too large. (2) there should be no immediate or prospective indication for the rapid completion of labor, because if, under such circumstances, the head did not at once engage, another operation—podalic version—would of necessity have to be performed. (3) the fetus must be very movable, which means that the bag of waters must be intact and the pains absent or weak. Placenta prævia, prolapse of the cord, and monstrosities are contraindications, and a fat or tender abdomen may make the maneuver impossible.

External cephalic version has very limited application, but I am convinced it is used more than it should be. Most accoucheurs prefer to wait for complete dilatation of the cervix and then do podalic version and extraction.

**Wiegand's Method.**—Anesthesia is rarely needed, but the patient must learn to relax the abdominal muscles. By using a partial Trendelenburg posture the child falls away from the inlet and

becomes more movable. One hand is placed over the breech, the other over the head, and by alternate stroking and pushing movements the head is brought over the inlet. Operating between pains one holds, during the time the uterus is contracting, what has been gained. Time is no object, and force may not be used. Now the foot of the table is lowered, and the head forced down into the inlet, where it is held for five minutes or until the pains fix it there. If the cervix is completely dilated, and if the cord or the extremities have not prolapsed, the bag of waters may be ruptured, still holding the head firmly in the inlet. If the cervix is not dilated, or if the cord lies over the os, the membranes may not be ruptured. Combined internal and external version to bring the head over the inlet is almost never practised nowadays, though it should be.

**Wright's Method of Combined Cephalic Version.**—In Sc. L. A. the right hand grasps the shoulder girdle and presses the child's body in a curvilinear direction to the right, while the left hand, operating on the abdomen, forces the breech in a curvilinear direction upward and inward toward the left. The shoulder is not pushed upward more than is sufficient to dislodge it from the inlet, and no direct action on the head is made, but after the head has come down it is received in the hollow of the right hand and led into the pelvis in a manner similar to that shown on page 959, Fig. 822. Gentleness and patience are required for success. Dilatation should be complete or nearly so, an indication for immediate delivery absent and the child living.

**Podalic Version.**—When version or turning is mentioned, it is usually the podalic one that is meant, and it is preferred, because—(1) As a rule, cephalic version is too difficult or impossible; (2) there is an immediate or prospective indication, either on the part of the mother or the child, for rapid delivery; and (3) there is often slight pelvic contraction. Lately the latter indication is being much restricted in favor of pubiotomy and cesarean section. If a case of transverse presentation occurs in a contracted pelvis, the pelvis and not the presentation of the child decides the course to pursue.

Very few operators try to turn by the breech with external manipulations alone, but I have several times succeeded in doing so, and it is almost always possible if the case is simply one of deflected breech presentation. There are two methods of combined or bipolar version which are employed, according as the cervix is open enough to admit the hand or only enough for one or two fingers. The name of Braxton Hicks is most often associated with the last method, because he did so much to popularize it. The other method might, with propriety, be called "bimanual" version.

Which of these methods is used depends on the condition of the cervix and the mobility of the fetus. If the cervix is completely dilated, bimanual version, rupturing the bag of waters, is performed. If the cervix is not dilated and the bag of waters is intact, it is best to wait. One may not go away, but should stay by the patient so as to interfere when needed. If the cervix will admit only two fingers but the bag of waters is ruptured, Braxton Hicks' version is indicated. It is dangerous to wait after the bag of waters is ruptured for the cervix to dilate to a size sufficient to allow the hand to pass through. Braxton Hicks' version should be considered, and if not thought feasible, a metreurynter should be put into the lower uterine segment to preserve the balance of the liquor amnii, to keep the shoulder away from the inlet, and to prevent prolapse of the cord and extremities. When the cervix is well dilated, the time is ripe for the bimanual version. Should an indication on the part of the child for rapid delivery arise before full dilatation is accomplished, the various methods of opening the cervix must be taken up as additional preparatory measures. Version, followed by extraction through an only partly opened cervix, is a dangerous and often fruitless operation.

**Bimanual Version in Transverse Presentation.**—Few operations are so satisfactory as version, but none is more dangerous if performed without due consideration of the conditions.

**Conditions.**—1. The cervix must be dilated enough to allow the hand to pass, and, if the version is done in the presence of an indication for extraction also, must be fully dilated; (2) the pelvis may not be too much contracted—this

in view of the extraction to follow; (3) the uterus may not be in tetanus or retracted over the fetus—that is, the case may not be one of neglected transverse presentation with the uterus on the point of rupture; (4) the child must be mobile, that is, not engaged, or in the process of spontaneous evolution; (5) unless the version promises to be exceptionally easy, the child must be living.

The third and fourth conditions require most careful thought; indeed, it is at this point that the art of the accoucheur comes into play. To know when it is safe to turn and when the risks of rupture of the uterus are too great requires much experience and delicate judgment. Only too easy is it to rupture a thinned lower



FIG. 824.—VERSION. FIRST MOTION. HAND INSIDE PUSHES UP THE SHOULDER AND FREES IT FROM GRASP OF THE UTERUS BY SMOOTHING AWAY THE UTERINE WALL.

In passing the hand through the vulva the labia are to be widely parted; the direction is at first downward toward the sacral hollow, then upward in the axis of the inlet, sinking the elbow downward, and the motion should be spiral, from left to right. The hand is well lubricated with lysol solution. While the outside hand steadies the uterus, the inner one gently pushes up the shoulder, and, by stroking the uterine wall, frees it from its grasp on the child, at the same time noting its thinness, or perhaps any present break in its surface.

uterine segment, and the inexperienced accoucheur would do better to err on the side of safety to the mother. It is impossible to lay down a set rule as to how long after the rupture of the membranes a version is still permissible. All depends on the degree of retraction and contraction of the uterus. The longer the time, the more difficult and dangerous the operation. I have done a turning three days after the membranes ruptured, and again have found it impossible two hours afterward.

The preparations are the same as for all obstetric operations. The instruments

required are those for the operation chosen for the delivery of the child—as for breech extraction. For the version, several slings are to be provided, a tape a yard or more long and  $\frac{1}{2}$  inch wide, and some sort of sling-carrier. For narcosis is needed for the actual turning, but later a lighter sleep is preferred. Most often the dorsal posture is sufficient, but in back-posterior position pendulous belly the lateral (the one on which the child's feet are) may be required. A modified Trendelenburg may be used instead. One is here governed by surgical conditions.



FIG. 325.—VERSION. SECOND MOTION. HAND SEIZING FOOT.

Passing the hand directly along the belly or side of the fetus, taking care to avoid the cord, the fingers successively, thigh, knee, and ankle. Aided by the outside hand, the upper foot is pressed into the grasp of the thumb and the two first fingers, which seize it, without making the hand into a knobby fist. This is avoided by the uterus might tear over the sharp knuckles, and, further, the fist and the body of the child make too wide for the safety of the lower uterine segment.

Which hand shall be introduced? That hand whose palm will lie again against the breech when in the uterus—when the breech is to the left, the right, when to the right, the left, hand. The bag of waters is usually ruptured; if not, the membranes are to be opened just as the hand passes the cervix; the forearm then will be introduced to the vulva and prevent the escape of all the liquor amnii.

Which foot is to be seized? All authorities recommend to bring down the foot in back-anterior presentations, and Simpson and Hohl urged to get the foot in back-posteriors. They claimed that then the back of the baby would come anteriorly, which would be more favorable in the subsequent

tion. This is my practice, but in cases where it is at all difficult to reach the feet, I usually take that one which I first identify as such. The version is to be made on one foot, if possible. This leaves the other leg and thigh to add volume to the breech end of the fetal pole, and thus produce greater dilatation of the cervix, which renders the passage of the head easier.

What to do with a prolapsed arm? It is best to put a sling on it, then lay the end of the tape in one groin. Later, during the extraction, an assistant keeps up light traction on it to hold the arm alongside the trunk. This is good practice, as



FIG. 828.—VERSION. THIRD MOTION.

Gently the foot is drawn into the pelvis, sliding it down the wall of the uterus behind the pubis. In back-anterior presentations the foot is led down posteriorly near the sacro-iliac joint, where there is more room. The outside hand aids the turning by pressing the head toward the midline and upward. During the uterine contraction no motion may be made: the hands are to be absolutely quiet. Between pains the operation is renewed. At all stages the back of the internal hand should feel the wall of the uterus and discover a separation of its fibers, or a beginning abruptio placenta. When the knee has passed the vulva, the version is complete; the head will now be found in the fundus.

If there is difficulty in performing this act—the actual turning—see that the narcosis is deep enough to paralyze the uterus; pass the hand around the child to find if the shoulder is caught on the pelvic brim, then, if necessary, bring down both legs.

If, during the operation, the hand instead of the foot be brought down, no harm is done—a sling is put on it. It is rare not to be able to reach the feet—then the knee may be pulled down. If the cord prolapses, the version must be hurried. Such an accident is to be avoided, if possible, and shows the wisdom of procuring complete dilatation before turning. Should, during the operation, a beginning rupture of the uterus be discovered, further attempts to turn are too dangerous—cesarean section is considered, and, if this is contraindicated, embryotomy is required.

It dilates the cervix more and renders much easier the delivery of the arms and shoulder-girdle. I often bring down the arm purposely to put a sling on it. Should the arm prolapse before the cervix is prepared for delivery, it may be replaced in the uterus and a bag inserted to procure complete dilatation.

After the version is complete, the operator has fulfilled the indication for which the operation was done. He assures himself that the child is in good condition (fetal heart-tones), and that the placenta has not been abrupted by the manipula-

tions (external hemorrhage and bad heart-tones); further, he has nothing to do. Often during the version the child suffers and the heart-beat may be very slow after the turning is completed. It is wise to watch a while before extracting, because usually the child recovers quickly. A hasty delivery would hurt the child more—its chances would be improved by a short respite. It is best to leave the delivery to nature, but the accoucheur may not leave the woman. She is to remain on the table, or temporarily put in a bed near by. If an indication on the part of



FIG. 87.—VERSION IN Sc.L.P. WITH PATIENT ON SIDE.

For back-posterior position, the lateral posture or a modified Trendelenburg is best. The hand is to be passed behind the pubis anteriorly, but enters the vagina and rounds the inlet, as in Sc.L.A., the elbow being well exposed. Preferably, the upper foot is grasped, but not if there is too much trouble to get it. This turns the child to the front, but if the lower foot needs be taken, it is easy, in the following extraction, to favor rotation to the front so as to bring the back anteriorly.

the mother or child arises, extraction may be performed in the classic manner. Expediency—for example, the accoucheur not having time to await the natural expulsion of the child—is a poor indication for extraction.

**Podalic Version in Head Presentation.**—*Indications.*—1. Abnormal attitude of the child—face and brow, anterior and posterior parietal bone presentation. In face and brow cases version is preferred by many to attempts to convert the presentation to an occipital. If the face or brow case is complicated by a prolapsed cord or placenta prævia, etc., version is the operation of choice, when vaginal delivery is to be attempted. Anterior and posterior parietal bone presentation usually are caused by contracted pelvis, and this, not the abnormal presentation, should give the indication: 2. prolapse of the cord and of extremities: 3. placenta prævia: (4) any complication on the part of the mother or child which demands the rapid termination of labor, when the conditions for forceps are not fulfilled, for example, non-engagement of the head: 5. contracted pelvis of mild degree.

The last indication is the most discussed one, and is not yet settled. The operation of version for contracted pelvis is called "prophylactic version" (Fritsch) and comes into competition with prolonged expectancy, and later, if the head does not engage with the high forceps. Paré, in 1550, recommended this operation, and it has been done ever since. The question is, does the head pass through a slightly contracted pelvis easier coming last than going first? Ex-



perience and experiment on the cadaver prove that it does, but it has to come through quicker, and as a result many babies die. Wolff and Leopold showed that the results were about the same. The amount of damage done the children and the mother is about equal; it remains, therefore, a matter of personal choice. British accoucheurs, prominently Kerr, have given up prophylactic version in favor of prolonged expectancy and forceps, which is the position I take in the matter.



FIG. 323.—PODALIC VERSION IN OCCIPUT PRESENTATION. GRASPING THE FOOT.

Inserting the hand past the head into the lower portion of the uterus, the operator quickly perceives if there is any dangerous thinning of the wall or if the contraction ring is tetanically contracted about the child's neck. Aided by the outside hand forcibly pressing the breech down, the anterior foot is seized by the inner hand without flexion of the fingers. Deep narcosis is required.

**Conditions.**—(1) The cervix must be dilated enough for the method of version chosen, and if the operation is done to save the child, it must always be fully effaced and dilated; (2) the head must be movable, not engaged, but under profound anesthesia an apparently fixed head may often be easily pushed up into the false pelvis; (3) the pelvis must be roomy enough for the extraction to follow; (4) the soft parts may not be too rigid—in primiparæ version is to be restricted to the minimum possible; with some accoucheurs primiparity contraindicates version; (5) the uterus may not be in tetanus or on the point of rupturing.

**Methods.**—Of these there are three: Wiegand's external version, the bimanual, or combined internal and external, using the whole hand in the uterus, and Braxton Hicks', inserting only one or two fingers through the cervix. What was said about version in shoulder presentation regarding preparations, posture, hand to choose, bag of waters, prolapse of the cord, and rupture of the uterus applies here. The anterior foot is the one to seize, because it brings the back to the pubis. In face cases it is necessary to pass the hand far up into the fundus, but it is also wise first

to bend in the child's chest curve and force the breech down on to the internal hand, making the child more of a ball than of long cylinder shape. The "double manual," a procedure invented by Justine Sigmundine, consisting of pulling on a sling attached to the leg while pushing the head up with the hand from the inside, and the manœuvre illustrated in Fig. 831, are often needed.



FIG. 829.—PODALIC VERSION IN OCCIPITAL PRESENTATION.

While drawing the foot down in the axis of the os, the outside hand pushes the head of the child directly inward toward its belly, thus making a ball of its body, which thus rotates better in the uterus. When the knee is at the vulva, the pressure on the head by the outside hand is upward.

Braxton Hicks' version has a limited application because, in cases where version is indicated, it is almost always desirable to be in a position to extract the child when the turning is complete, and, too, as we have seen, often an accident happens during the operation which demands immediate extraction. Therefore the author recommends, in all cases where possible, to procure complete dilatation of the cervix before attempting to turn the child.

The main indication for Braxton Hicks' version is placenta prævia. It is sometimes done for prolapse of the cord, occasionally in shoulder presentations, and

very exceptionally to turn the head down in breech presentation. The conditions are the same as for the operation last described, but the mobility of the fetus must be absolutely free.

**Cephalic Version in Breech Presentation.**—While this is the very oldest kind of version, it is performed the least often. It was done by the ancients because

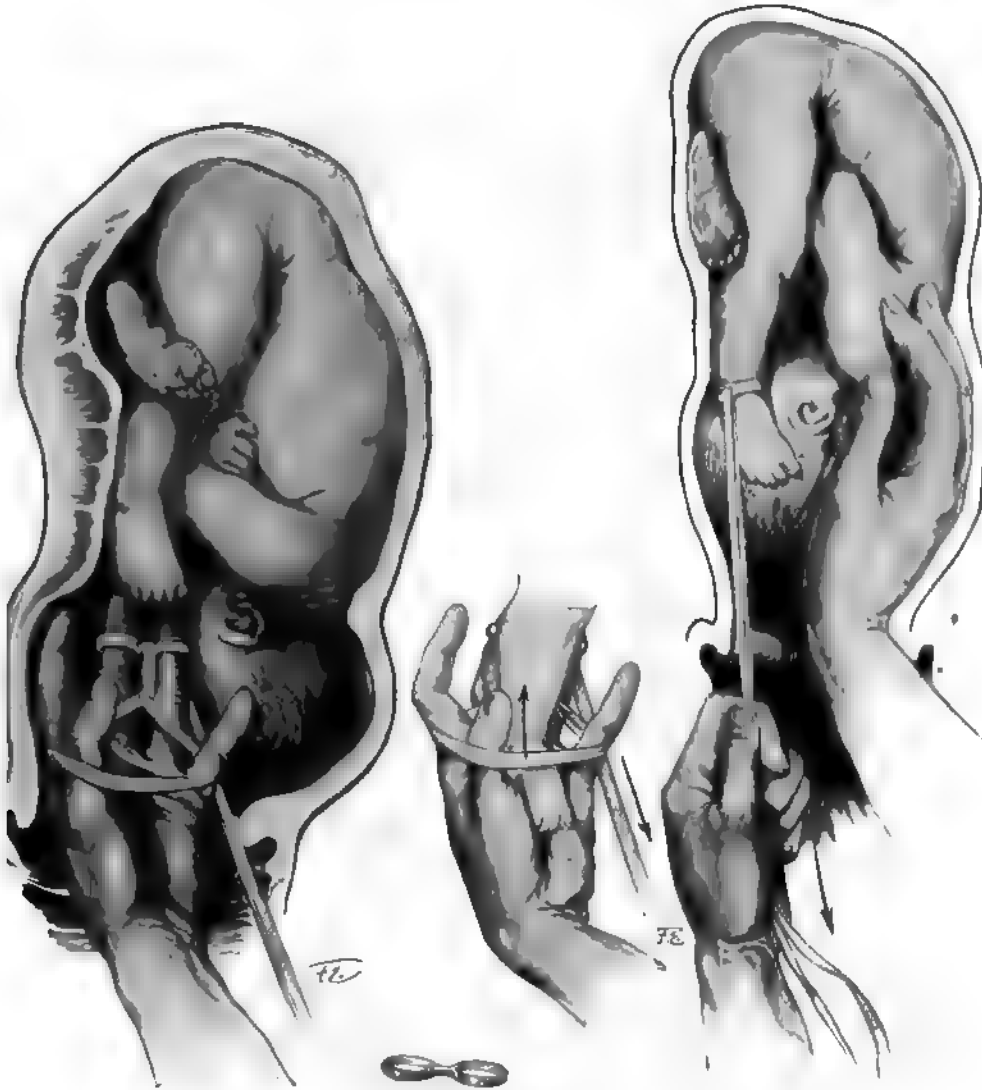


FIG. 830.—APPLYING A SLING TO FOOT WITH MORALES' SLING-CARRIER.

If the foot cannot be readily grasped or does not give purchase enough for traction, a sling may be put on it. The ringed bar of Morales is mounted on the middle and fourth fingers, a tape adjusted over it like a pulley, and the loop spread out by the little finger and thumb. When the loop has been adjusted around the part to be grasped (the foot or hand), pulling on the tape draws the loop upward and tightly around the member.

FIG. 831.—SHOE-HORN MANEUVER.

If the head is arrested by the contraction ring catching in the nape of the child's neck, one hand may be used, after the manner of a shoe-horn, while the other pulls on a sling attached to the foot. It is rarely advisable to bring down the two legs, but this and Sigmundine's maneuver may often be found useful.

they considered all other than cephalic presentations pathologic and insuperable. During pregnancy, if breech presentation is discovered, an attempt to change it by external manipulation is justifiable, though it does not always succeed. The knee-chest posture assumed three or four times daily may facilitate the rotation of the fetus. During labor in a primipara with breech presentation, with or without a

contracted pelvis, it may be desirable, though seldom possible, to bring the head down. Cephalic version might also be a preparatory operation before pubiotomy. The dangers of the operation are detachment of the placenta, coiling and prolapse of the cord, and recurrence of the breech presentation. The usual conditions for version must be insisted on, especially full mobility of the child, but the pressure



The following are the conditions which must be met before attempting a version:

1. The fetus must be dead or nearly dead.

2. The placenta must be attached to the uterine wall.

hand, and by the Braxton Hicks' method. The breech is pushed upward and to one side, while the hand outside strokes the head along the inner wall of the abdomen toward the inlet. When it has been brought over the brim, it is grasped as in Fig. 818, p. 955, and forced down into the pelvis, or pulled in by the forceps. In these cases, also, it is wise to procure full enlargement of the cervical canal before operating, so as to be able to care for all possible accidents—for example, prolapse of the cord or abruptio placentæ—by immediate delivery.

The prognosis of version may never be lightly estimated. It depends largely on the skill of the operator. The operation may be directly fatal to the mother from rupture of the uterus, of the cervix, or from abruptio placentæ. The danger of rupture of the uterus during version cannot be too strongly emphasized. For the child, the conditions requiring the interference usually determine the outlook. The turning itself, unless unduly prolonged by complications, by abruptio placentæ, or by prolapse of the cord, affects the infant but little.

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## OPERATIONS OF DELIVERY

UNDER this heading will be considered those operations which remove the child from the parturient canal—breach delivery, forceps, craniotomy, and cesarean section. The technical term "extraction" would apply to all such maneuvers, but law has limited it to the removal of the unmatulated child through the natural passage.

The difference between spontaneous and artificial delivery must always be borne in mind. In spontaneous delivery the fetal body is compressed into a smoothly rounded cylinder, the uterus contracts upon it evenly from all directions.

In artificial delivery, whether by the hand or the breech, when traction is put on the fetal extremities, it is broken at several places — for example, at the neck, the shoulders, between the ribs, and at the shoulders — as in breech presentation.

In addition, the energy is not smoothly applied to the fetus, but may be caught at the joints or any movement of its body. Further, the impairment of a sharp point of the fetus may cause anomalous contraction and it is well known that such contractions synchro-nize with the uterine contractions of the mother. It is well known that the fetus is completely by harness.

## EXTRACTION

**General Indications.**—Why should we desire to deliver the woman? We must we extract the child? Here is the latest indication in a few words. We deliver the child because the mother is unable to do so. The indication for extraction therefore is insufficiency of the power of labor and as Schultz says the general indication may be subdivided into three distinct weaknesses of the power of labor, namely:—1. Insufficiency of the power of contraction; 2. Insufficiency of the power of dilatation; 3. Insufficiency of the power of rotation. Under the first head we may place the cases of the woman who has a weak cervix, weak pains, thin muscular walls of the uterus, or whose cervix is too short or too rigid. Under the second head we may place the cases of the woman whose cervix is too rigid, or whose os is too small, or whose pelvis is too narrow. Under the third head we may place the cases of the woman whose pelvis is too narrow, or whose cervix is too rigid, or whose os is too small.

On the other hand, the fact that the  $\beta$  phase is not observed in the  $\beta$ -phase region of the phase diagram of the  $\text{Cu}-\text{Zr}$  system [10] may be due to the fact that the  $\beta$  phase is not stable in the  $\text{Cu}-\text{Zr}$  system. The  $\beta$  phase is not observed in the  $\beta$ -phase region of the phase diagram of the  $\text{Cu}-\text{Zr}$  system [10].

5. 在 2000 年 12 月 31 日，公司应计提的坏账准备为 100 万元。

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If pubiotomy or embryotomy is in reserve, the degree of contraction may not go below  $7\frac{1}{2}$  cm. and  $6\frac{1}{2}$  cm. respectively.

(2) The cervix must be effaced and the os dilated. This condition is important in relation to the ease of the extraction, the integrity of the maternal tissues, and the life and safety of the child. If it is necessary, in the interests of the infant or the mother, to deliver before this prerequisite is fulfilled, the cervix must be opened by one of the preparatory operations—metreuryasis, incisions, etc. The



FIG. 834.—SECOND ACT OF EXTRACTION. DELIVERY OF BREECH TO SHOULDER.

An assistant makes continuous even pressure over the whole uterus with both hands. The accoucheur takes the breech in two hands, with the thumbs over the back of the sacrum, the index-fingers resting on the anterior superior iliac spines, the others evenly distributed over the pelvis and thighs. Gentle, even traction is made downward in the direction of the axis of the inlet until the anterior shoulder-blade becomes visible or palpable under the pubis.

evils of extraction before dilatation is complete have been referred to, and will bear reiteration.

(3) Before delivery the bag of waters must be ruptured.

(4) With few exceptions one must insist that the child be living.

If the child is dead, embryotomy is, as a rule, a preferable operation. If in doubt, the child gets the benefit, within a reasonable limit.

(5) In cephalic presentations the head must be engaged in the pelvis, or so nearly engaged that it is almost certain that a slight pull from below will complete the engagement. (*Vide Forceps.*)

**Extraction by the Breech.**—The reader is referred to p. 621 for the details of the treatment of breech presentation.

**First Act.**—How to deliver the breech will depend on its station or location and upon the attitude of the child. If the breech is deeply engaged in the pelvis, a little traction with the finger in one groin may suffice; if one or both feet are down, traction is made on the extremity. The following methods have been employed to deliver the breech: (a) Bringing down one leg; (b) the finger in the groin; (c) the use of a fillet or sling placed over the groin; (d) a blunt hook, or two hooks, one in



FIG. 836.—DELIVERY OF ANTERIOR ARM TURNING ANTERIOR ARM TO HOLLOW OF SACRUM.

Sometimes it is easy to pass two fingers over the anterior shoulder down to the elbow of the anterior arm and disengage it from behind the pubis, in a manner similar, but reversed, to that just described, but if not easy on the first attempt, the child is allowed to fall onto the hand which delivered the arm, the arm is laid as a splint alongside the chest. The operator grasps the chest of the child with both hands, the index-finger of the second hand obtaining a purchase on the anterior scapula, and the other fingers being evenly distributed over the thorax. Then, with gentle rotation, the anterior arm is turned to the back, following the direction of the child's belly, and the now-posterior second arm and shoulder are delivered, reversing Fig. 835, p. 974.

each groin, or specially constructed forceps, shaped like hooks; (e) use of the obstetric forceps on the breech.

Of all these methods, extraction on one or both legs is by far the best, and I have not yet met a case where it was impossible to get a foot down. Deep anesthesia and the Trendelenburg posture have always enabled me to reach the extremity, no matter how firmly the breech seemed wedged into the pelvis at the start. In cases of contracted pelvis, unless cephalic version is to be performed, it is advisable to bring down the foot, and in pendulous abdomen it is also desirable, the leg straightening out the child in the axis of the inlet, which permits the uterus to work to good advantage. In single breech presentations the maneuver is the



probability, lose the child. The rigid cervix delays the extraction so long that the child succumbs, unless the accoucheur is prepared to make deep incisions into the constricting structures.



FIG. 838.—BRINGING DOWN FOOT. PINARD'S MANOEUVRE.

Passing the hand high up into the uterus, avoiding the cord, which is kept on the back of the hand, the index-finger is pressed into the popliteal space. This shortens the hamstring muscles and flexes the leg, upon which the three fingers slip over the knee to the ankle, the foot now being wiped along the other thigh posteriorly into the pelvis and out. During the pains no move may be made—the hand should lie passive until the uterus relaxes.

FIG. 839.—DELIVERY OF ANTERIOR HIP.

Laying the thumbs parallel to the long bones and distributing the fingers evenly over the rest of the limb, traction is made downward in the axis of the inlet until the crest of the ilium has passed the ligamentum arcuatum, the hands being adjusted higher and higher as the limb appears. No bending nor twisting motions are allowable, and the action must be smooth, not jerky.

*Complications During the First Act.*—If the posterior leg is brought down, the anterior hip may catch on the pubic ramus. Sometimes the operator brings one



FIG. 840.—DELIVERY OF POSTERIOR HIP.

As soon as possible the index-finger—only one finger—of the other hand is passed over of the ilium, into the posterior groin, and with combined traction the whole pelvis is brought out. The second leg is allowed to drop out.

In babies it is wise to deliver the arms before the shoulders have been delivered.

ut. The posterior arm is first delivered. Episiotomy is the rule in primiparæ, as the thickness of the hand added to that of the chest is usually too much for perineum. It may be well to push the child back a little to loosen the arms from the wedge-like action of the head. If it is too hard to get the posterior arm,

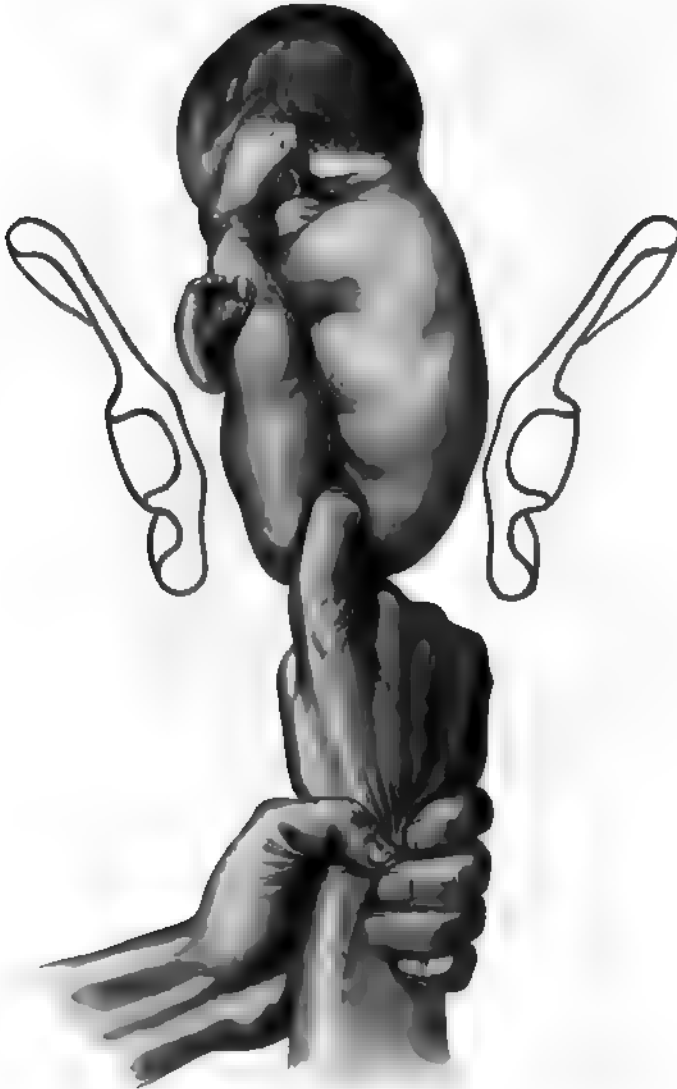


FIG. 841.—DELIVERY OF BREECH WITH FINGER IN GROIN. OTHER HAND SUPPORTS WRIST.

When extracting the breech with one finger in the anterior groin the whole hand is placed in the vagina, the finger from in front, while the thumb seeks to aid a better grasp on the pelvis. Traction is to be made downward, pull must be toward the belly of the child, to avoid injury to the structures in the inguinal region and of the femur. This operation is very tiring, hence the hands may be changed and the wrist supported as in Fig. 841. Episiotomy and patience are required. As soon as the posterior groin is accessible, the index-finger of the other hand is placed in it, and delivery of the breech accomplished easier.

The child may be rotated ventrally so as to bring the anterior arm to the hollow of the sacrum, and this arm is liberated first, then the trunk is rotated back for the posterior arm. If the operator's fingers are short, or if the arm is very high up, the whole hand should be passed in to get the arms. Then the thumb should lie parallel to, and opposed to, the fingers, and it may not be used to grasp the arm. During

these manipulations the assistant should not exert pressure on the fundus since this renders internal manipulation difficult.

A second and a bad complication occurs in the third act, when the arm is thrown back into the nape of the neck and crosses the pelvis under the head. This is usually caused by anomalous rotation of the child's trunk, and is common in version and improper efforts at extraction (Fig. 843). This condition is rectified only when the fingers are passed in to liberate the posterior arm. Without this the body of the child is pushed back, or stuffed in a few inches, to release the arms from their imprisonment by the head, and the half hand is inserted directly into the child's back to the forearm. This, then, is pushed up, the fingers wiping the elbow and forearm over its face, past the sacral promontory to the other side of the pelvis, down and out. If this does not succeed the first time, the child should be pushed back a little further and the maneuver tried once more, failing which the anterior arm should be liberated. Grasping the chest as indicated in Fig. 8



FIG. 842.—ARMS STRIPPED UP. WHOLE HAND REQUIRED TO BRING THEM DOWN. The thumb may not be used to grasp the arm

975, the child is rotated ventrally so as to bring the anterior arm behind; with four fingers deeply inserted, or even the whole hand, the just mentioned maneuver with the child's forearm is carried out. Rotation of the trunk much facilitates the release of the arm.

It is not allowable to pull down on the shoulder to make the arm and more accessible. Fracture of the clavicle is the certain result. Nor may the arm be brought down over the back, obviously, for the same reason. If the accoucheur will go at his work deliberately, it will not be needful to exert brute force and fracture the clavicle or humerus. To try to deliver the head without previous liberation of the arms (Deventer) is not good practice.

Kustner recommended, where difficulty is apprehended, to bring down the anterior arm immediately after the navel appears, and Guffey advises this for all cases. In version cases it is good practice to put a sling on one arm prophylactically.

*During the Fourth Act.*—Arrest of the head may occur at the pelvic inlet, and after it is in the excavation or at the outlet. If the child is large or the pelvis small, the head wedges into the inlet with the sagittal suture in the transverse diameter. Extension occurs and the mouth is thrown up high—sometimes above the brim. Treatment: Wiegand-Martin's method, remembering that the chin is high up and to the side, that the head must be brought through the inlet in the transverse diameter, that it should not be strongly flexed, and that it may not be rotated to bring the occiput forward until it is deep in the excavation. The pull must be downward in the axis of the inlet, hence the patient is best on a high table, but most of the work is to be done by pressure with the outside hand. Where this



FIG. 843.—ARMS IN NAPE OF NECK.

method fails, the Mauriceau-Smellie-Veit method is tried (Fig. 844). One hand searches the mouth, and two fingers are placed, as before, on the lower insertions of the pterygomaxillary ligaments. The other hand is placed fork-like over the shoulders, with the finger-tips resting on the sternum, not on the sides of the neck. The knuckles rest against the mastoid processes. While an assistant presses the head forcibly downward from without, the operator pulls gently, but firmly, downward from within, observing the mechanism just described. In particularly difficult cases the Walcher position may be used, and the operator, by pushing the head to one or the other side of the promontory, may gain more room for the large bipa-



FIG. 844.—MAUCENEAU-SHELLIE-VEIT METHOD, AIDED BY OUTSIDE HAND.



FIG. 845.—FORCEPS ON THE AFTER-COMING HEAD.

An assistant holds the child up and out of the way with its arms behind the back, and the blades are applied in the usual manner. In his hurry the operator may not forget the usual precautions to safeguard the cervix, perineum, and the child.

rietal diameter to pass, or, by tilting the head upward or downward, may seek to bring the biparietal plane through the inlet on a slant. *Non vi, sed arte* applies with double force in this operation.

If the head will not come into the pelvis under the exhibition of moderate force applied above and below, it is best to desist, because the end sought, a living child, will be defeated by the attempt itself, and the mother will suffer irreparable injury. Now there is no occasion for hurry. Craniotomy should be performed. In prac-



FIG. 846.—LETTING AIR TO CHILD'S LUNGS WHEN HEAD IS ARRESTED IN BREECH DELIVERY.

tice there is usually no compunction about such a course, since the child has almost always died by this time.

Forceps, useful later, are hardly applicable when the head is high up in the inlet. They are then dangerous to the mother and barren of results.

When the head is arrested in the excavation, a quick examination determines if the delay is caused by the cervix or by the bony pelvis. A tight cervix must be stripped back or cut, which is not always a simple matter. If the methods of delivery just mentioned do not show immediate results, the forceps should be applied to the after-coming head. My practice for years has been to apply forceps

to the after-coming head if it does not quickly follow moderate traction, and recommends it very highly, quoting also Smellie, Barnes, and Hermann in its favor. Williams opposes the practice, as do some of the German authorities, though —Nagel, Klien, Kehrer, Credè, and others, and French operators, Bar and Tarn employ the instrument in some cases. I am convinced that many children have been saved, that fracture of the clavicle, hematoma of the sternomastoid, dislocation of the vertebrae, Erb's paralysis, and many lesser injuries could be avoided by application of the forceps to the after-coming head were taught in the school more generally practised. It is a more humane way of delivering the head in cases of moderate difficulty than the Mauriceau-Smellie-Veit method. At least, in breech cases the forceps should be ready for use.

A very valuable manœuvre, practised for many centuries, is the retraction of



FIG. 847.—BRINGING DOWN ARM IN BACK TO BACK POSITION. ARROW INDICATES DIRECTION OF MOVEMENT.

the perineum by the hands or by broad specula, wiping the vagina dry and allowing the child to breathe with its head still in the pelvis (Fig. 846). A stiff rubber tube may also be inserted into the child's pharynx. Stowe, in one case, did tracheotomy and saved the infant.

**Abnormal Rotation in Breech Cases.**—Thus far we have considered the operation of delivery when the mechanism of labor has been the usual one—that is, with the back anterior. In vertex presentations, we have errors in the mechanism due to abnormal rotation. In breech deliveries the child's back turns to the mother's back, and the belly lies forward of the pubis. This complication occurs oftener in footling presentations when the posterior foot has come down, after version when the operator has seized the posterior leg, and, rarely, in an otherwise natural breech labor when improper attempts at rotation have been made. As said in discussing breech presentation, nature almost always rectifies the abnormal start in mechanism by turning the back three-fourths of a circle, making it rotate the long way past the promontory, through the outer half of the pelvis to the front. The back rotates in a direction opposite from that which one would expect. An acute observer will notice this tendency of the breech to swing around in front of the sacrum. By not appreciating this point and attempting the mechanism sought by nature, the accoucheur may cause the back to remain behind. During the first and second stages this is of little moment. Watching the rotation in the third stage, by nature, the operator seeks to aid it by pulling harder on that groin which tends to turn the



In a few cases, even when the posterior limb is down, the back takes the "short route," through one-fourth of a circle, to the pubis.

*Abnormal Rotation During the Third Act.*—The arms may lie folded across the chest, may be stripped up alongside the head, or may be crossed in the nape of the neck. In the first case the latter is very simple. The child is supported a little above the horizontal with one hand, while two fingers of the other go in over the back, over the shoulder, down the arm to the elbow, and wipe the forearm over the chest, out from behind the pubis, the usual manoeuvre being reversed. It may also be possible, sinking the trunk toward the floor, to go directly to the forearm from behind the pubis, and, indeed, this may be the only way if the child is large or the pelvis small—



FIG. 848.—ROTATING HEAD BY CONJOINED MANIPULATION.

There may be no room behind. When the arms are stripped up above the head, great difficulties are usually met, and if they are in the nucha, it may be impossible to liberate them without fracture. Under no conditions may the arms be brought down over the child's back. In the first place, if the accoucheur sees that the child's back remains persistently posterior, he will bring the arms down as early as possible. It is sometimes necessary to pass the whole hand into the parturient canal in order to reach the arms—especially if the accoucheur has short fingers. This overdistends the vagina and perineal floor, hence a deep episiotomy is made, as a rule. Some authors recommend that the arms be brought down after sinking the child's trunk and entering and operating behind the pubis. I prefer, with Fritsch and the majority, to raise the body of the child somewhat (one cannot pull it up so far as when the back is anterior), and pass the four

fingers from behind up to the head and push the forearm forward and to the opposite anterior quadrant of the pelvis, then down over the chest, as in Fig. 847. If the first attempt does not succeed, the trunk of the child is rotated, at the same time stuffing it back somewhat to free the arms above the inlet, and the anterior arm is delivered first. The child is now turned back so the other arm to come behind. Pulling on the shoulder to make the arm more accessible fractures the clavicle. In a few cases I was able to aid the internal hand by letting an assistant support the body of the child, while I pushed the arms into proper position from the outside. External manipulation is not used enough in our obstetric operations. In only one case from a very large number was I constrained deliberately to break the arm in order to preserve the life of the child, which was jeopardized by the delays in the delivery. It is wise to announce this necessity beforehand. A. Müller's procedure, delivery of the shoulder-girdle without previous liberation of the arms, is not to be recommended since fractures of the extremities and rupture of the spinal column are very common. The operation is not artistic, but brutal.

*During the Fourth Act.*—Referring to the chapter on Abnormal Mechanisms with Breech, it will be found that the head may be arrested at the inlet with the chin caught over the promontory, or the head may engage in the pelvis with the chin to the front, and that nature may terminate these cases in two ways—one is by flexion: the body depends, the chin remains applied to the sternum, and the face, forehead, and vertex roll out from behind the pubis, the nape of the



FIG. 849.—VAN HOOEN'S METHOD, AIDED BY OUTSIDE HAND.

neck resting on the perineum: the other is by extension: the chin leaves the sternum, and if the child is lifted up to the belly of the mother, the occiput, vertex, and face come over the perineum, the neck resting behind the pubis, and the face issuing the very last.

In the first case the accoucheur may attempt to turn the head so as to bring the occiput to the front, the chin to the rear or to the side, if the pelvis is a flat contracted one. LeChapuis passed the hand in on the side opposite that on which the chin lay and tried to pull the face around. Zweifel recommended pressure with four fingers on the upper jaw. In four cases the following maneuver succeeded quickly: Two fingers behind the pubes obtained a purchase on the male bone, and while pushing this to the rear, the outside hand pulled the occiput to the front (Fig. 846). Now the mouth was readily accessible, and the usual mechanism could be carried out. In another case I pushed the chin to the side with the outside hand, while the inside hand pulled the occiput to the front.

If rotation of the head does not quickly take place, it may be better, since seconds are very valuable, to try to deliver the head without turning the chin behind. Van Hooen's method is used if the occiput has not engaged in the pelvis, combined with pressure on the forehead from the outside (Fig. 849). This pressure should do most of the work. The child is lifted up over the pubis to which its chest applies, and thus the occiput rolls past the promontory into the hollow of the sacrum. Too much force exerted now will break the child's neck. When the occiput comes into the hollow of the sacrum, the accoucheur quickly determines if the mouth of the infant is

accessible behind the pubis—that is, if extension or flexion is present. If the finger can be inserted into the mouth, the Mauriceau-Smellie-Veit method upside down is performed; if extension has occurred, the chin lying above the pubis, a modified Van Hoorn's method is practised. I believe the forceps would be preferable to either of these manœuvres. Indeed, the necessity for them is of the greatest rarity, since it is almost always possible to bring the head down in proper rotation.

A complete extraction by the breech, if properly executed, is one of the most brilliant operations, and, if the complications are successfully mastered without injury to the mother or child, it takes rank with the technically most difficult of all surgery. Every motion is the result of centuries of study and practice by the world's best accoucheurs, and the movements must follow each other with deliberation, exactness, and speed. Four minutes are allowed for the arms and four for the head. More time consumed endangers the child. It is a good plan for an assistant to count aloud the minutes. While a child may live five minutes after its placental circulation is cut off, it is greatly endangered, and may die later of atelectasis, pneumonia, sepsis, or the results of profound asphyxia.

Finally, attention should be drawn to complications offered by the soft parts. If extraction is undertaken before the cervix is fully dilated, dangers of no mean order are incurred for both mother and child. For the mother there is risk of tears of the lower uterine segment and cervix, which in placenta prævia are particularly fatal from hemorrhage. Sepsis is a later result. For the child the risk lies in the delay incident to the stripping up of the arms by the tight ring of the cervix, and, too, even after liberation of the arms the cervix may close down around the neck and face, at the root of the nose, buttonholing the head in the uterus. Traction in such cases brings the constricting cervix into view as a thick, purplish and white band. This ring may be carefully stripped back, or if too tight, may be incised. It may be possible to admit air to the child's mouth by means of specula and wait for the head to come through (Fig. 846, p. 983).

Deep lacerations of the perineum, even to the third degree, are very common in breech deliveries. They occur when the hand is inserted alongside the trunk or during the rapid delivery of the head. I make an extensive episiotomy in most breech cases, not alone to preserve the sphincter ani, but also to facilitate all the required manipulations, which save the child from asphyxia and from injury.

Lack of space prevents reference to the many accoucheurs who perfected each of the various manœuvres above detailed. The history of the operation of breech extraction may be found in the Edgar-Winckel Text-book of Obstetrics.

### FORCEPS

**Definition.**—The forceps of obstetrics is an instrument designed to extract the fetus by the head from the maternal passages, without injury to it or to the mother. As soon as the right of either is encroached upon, the instrument ceases to be the forceps of obstetrics, but becomes simply an instrument of extraction, similar to the craniotomy forceps, and not so good.

**History.**—Hippocrates advised pulling on the head with the hands, but probably used the manœuver only for small heads; the Arabians used a three- or four-bladed hooked tractor for dead fetuses; in 1554 Rueff, of Zürich, published a jointed forceps similar to that used in lithotomy; in 1561 Pierre Franco advised a three-bladed duckbill speculum, obviously impractical; the Japanese for centuries used whalebone loops and silk nets brought over the head by means of strips of whalebone; Smellie tried to draw fillets over the occiput and chin. It is remarkable that the idea of the obstetric forceps was so long in coming. As Schröder says, this was probably because men were not allowed at the confinement-bed except in the most difficult cases. And here, for lack of experience in normal cases, they knew little except to mutilate the child and extract it, and often the viscera of the mother, with sharp hooks. Unless the child presented by the breech or shoulder, so that the accoucheur could grasp a leg on which to pull, he was powerless, except as stated. Small wonder the women took alarm when a "man-midwife" had to be called, because they had observed, says Smellie, that "either the mother or the child or both were lost."

In 1720 Palfyn, of Courtrai, near Ghent, laid before the Academy of Medicine in Paris his forceps (Fig. 850, c) for the extraction of the child without mutilation. This rough, clumsy instru-

ment was modified by others. Dussè crossed the blades and lengthened them, and Levret, 174 added the pelvic curve, also the French lock, still used, though modified. The forceps depicted on Palfyn's memorial plaque in the cathedral in Ghent shows a pelvic curve.

The first forceps were invented probably in 1580 by Peter Chamberlen, the elder, the son of a Huguenot, William Chamberlen, who fled from Paris in 1569 and settled in Southampton. In 1670 Hugh, one of the large family, went to Paris and tried to sell the instrument for \$750 Mauriceau, to test the value of Chamberlen's pretenses, suggested that the latter attempt the delivery of a woman with extreme contraction of the pelvis, upon whom he had decided to perform

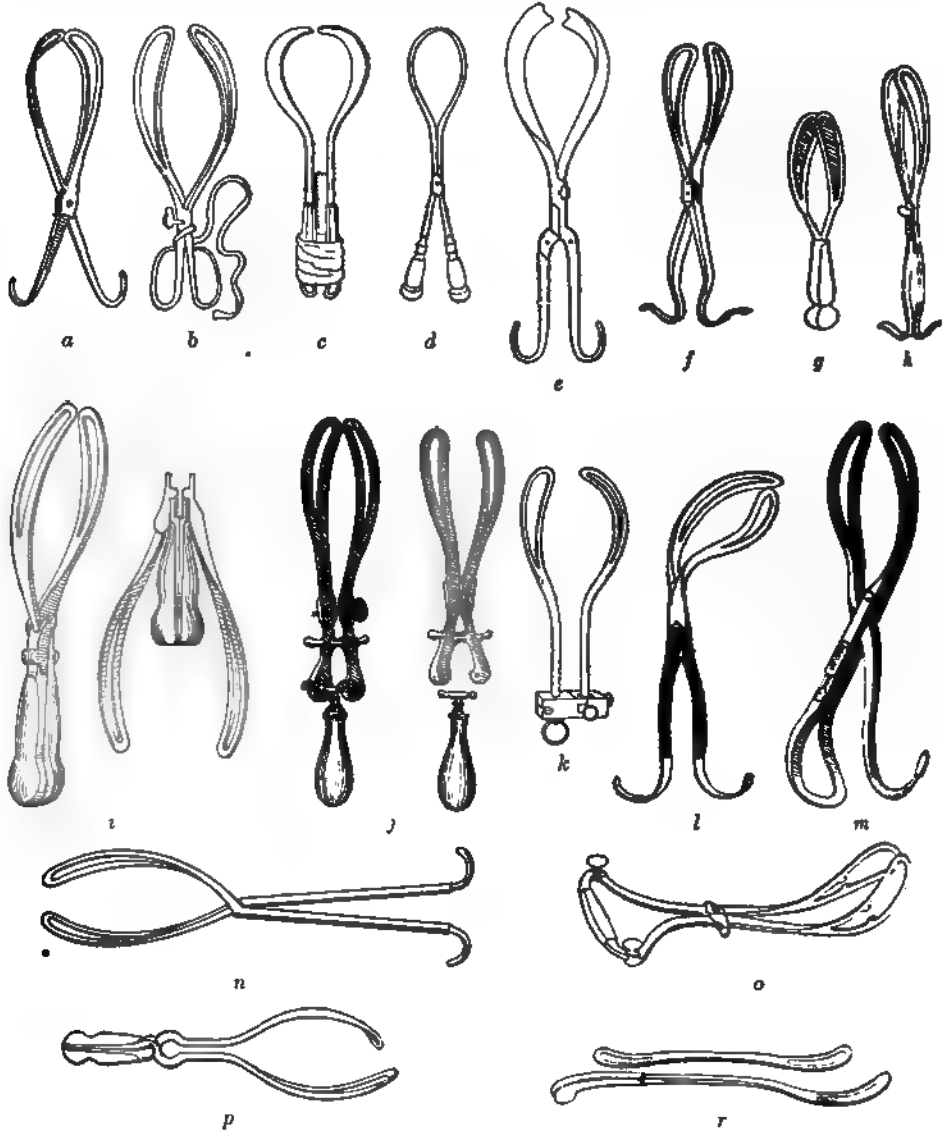


FIG. 850.—A FEW OF THE HUNDREDS OF FORCEPS MODELS.

a, Chamberlen No. 1; b, Chamberlen No. 2; c, Palfyn; d, Palfyn, 1721; e, Dussè, 1733; f, Gregory 1747; g, Smellie, 1752; h, Levret, 1747; i, Mathias Soxthorp, 1791; j, Couton, 1791; k, Hamon, 1807; l, Baumann, 1814; m, Santarelli, 1794; n, Japanese forceps; o, Chassagny; p, Rudford's asymmetric; r, Pean's vectis.

cesarean section. Chamberlen declared that nothing could be easier, and at once, in a private room, set about the task. After three hours of vain effort he was obliged to acknowledge his defeat. The woman died from injury to the uterus, the negotiations for the sale were dropped, and Chamberlen returned with his secret unrevealed to England. Later, after wrecking a bark, he fled to Holland, where he sold the secret to a Roehnhyusen, in Amsterdam, who sold it in turn to any doctor having the necessary large amount of money, but sold only half the forceps—the vectis,—adding fraud to infamy.

In 1753 Vischer and van de Poll purchased the secret and made it public, but by this time

rough Palfyn, Drinkwater, and others, the forceps had become common property. Palfyn, at the time seventy years of age, had walked to Paris to show his invention. It was not well received and he died poor and neglected, but in 1784 his resting-place in Ghent was marked by a statue of a weeping woman. The original forceps of the Chamberlens were found in 1815 in a hidden attic of a house in Essex, England, occupied by several generations of the family (Ingraham). Unnumberless alterations and modifications have been made on the forceps. Figure 850 shows a few of them, the only radical changes from the original Chamberlen and Dussè models being the addition of axis-traction by Tarnier in 1877.

**Description.**—The forceps consists of two blades, which are named right and left, according to the side of the mother's pelvis in which they lie when applied. Each blade has a handle and a hook-like projection, added by Busch. Gregoire (1740) put the fenestrum in the blade, but the Chamberlen forceps also had it. Some of the latest forceps are unfenestrated, for example, the McLane-Tucker. The blades are curved on the flat to fit the head,—the "cephalic curve,"—and on the edge to fit the concavity of the sacrum—the "pelvic curve." The two blades are fitted together by a lock, which in the English forceps consists of opposing shoulders with a flange; in the French forceps, a screw or pin; and in the German instrument, a sort of combination of both principles. Smellie and the English used very short forceps, because the operation was practised only after the head was well down in the pelvis. The French used long forceps, since they often extracted the head before engagement had occurred. The German forceps are rather long,

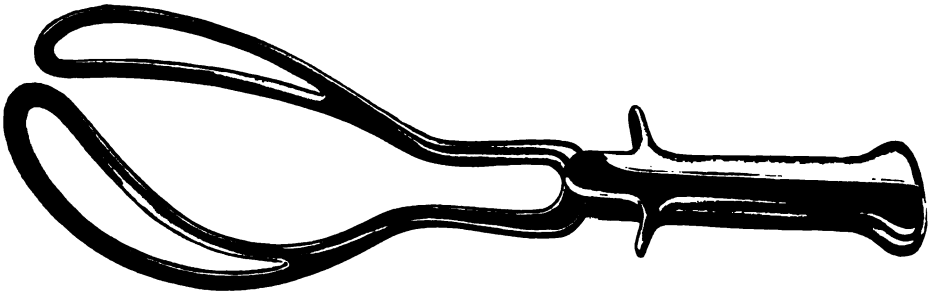


FIG. 851.—SIMPSON'S FORCEPS OR VIENNA SCHOOL FORCEPS.  
Handle slightly modified by author.

and resemble the French in having a small cephalic curve and a marked pelvic curve.

I have found that the best forceps for general use is the one of Simpson, as adopted by the Vienna School, often called the Vienna School forceps (Fig. 851). I made the hooks larger and flatter, so as not to hurt the hand, and modified the handles a little to secure lightness and ease of cleansing, but the essentials of the instrument are unchanged.

The function of the forceps is simply one of traction, as Levret pointed out in 1746. Some irritation of the uterus ensues after the blades are in place and may evoke pains. This is the so-called "dynamic action." An attempt to strengthen this very uncertain action by the aid of the faradic current was made, but failed.

The forceps is not a rotator, in the strict sense of the term—that is, the instrument may not be used to twist the head from one position to another, for example, from an occipitoposterior to occipito-anterior. Such motions tear the vagina off its pelvic attachments or even open the bladder. A certain amount of rotation may sometimes be given the head, together with horizontal traction, the movement being thus a turbinal or spiral one. This distinction is highly important. Even the turbinal movement endangers the soft parts to an extent.

As a lever, the forceps may also not be used, that is, pendulum motions are not permissible. The maternal soft parts are then the fulcrum, and will be bruised and torn. Levering and twisting are not observed in nature.

Compression of the head is inevitable, but we seek to reduce it to the minimum.

Experiments have proved what a little reflection would show, that we can reduce the volume of the fetal head but a few cubic millimeters by means of outside force, and even this is attended by great danger to the child. If one applies forceps to head of a still-born child in mannikin practice, it will be observed that closing blades causes the head to bulge out in the diameter at right angles to the direction of compression, but only slightly. What is more noticeable is the lengthening of the head in its long diameter, a point which Levret, Baudelocque, Budin, and Meigs



FIG. 552.—EXPERIMENT TO SHOW COMPRESSION EFFECT OF TRACTION.

Murray refer to. Much depends on the softness of the head and the shape of canal through which it is to pass. Reference to Fig. 552 will show how the head suffers compression in three ways. By squeezing the handles of the forceps together at  $P'$ , the action is that of a lever of the first class, the lock being the crum,  $F$ , the resistance being the head,  $R$ . Traction downward at  $P'$  acts in same way, but since the pull is on the short arm of the lever, the pressure at  $R$  will be less, were it not that in practice we put on more tractive force at  $P'$  than do compressive force at  $P'$ . The sum of the two compressions, however, will

considerable. The compression at P'' we can regulate ourselves, but the amount exerted at P' depends entirely on the amount of pull exerted to deliver the head. A third source of compression is the resultant of the pull of the forceps against the bony pelvis or the soft parts, that is, any resistance. Here again power is applied at P', or, as is advised in practice, at F, but the fulcrum is at X, and the power is applied to the long arm of the lever, obviously the most dangerous circumstance for the fetal head. This item of compression increases with the resistance met. Taking these facts into consideration, I must disagree with Barnes, believing that the compression is not one-half of the power of the traction, but probably greater than the traction. Compression of the head has very noxious influences on the brain. If suddenly applied, the child suffers from concussion. If slower in action, the circulation is hindered, the pneumogastric is stimulated, the pulse being slowed, and asphyxia resulting, or smaller or larger hemorrhages occur—all these outside of direct injury to structure or fracture of the bones. Children vary very much in their ability to stand compression. Some seem to have charmed lives.

Traction,—simple traction,—then, is the dominant function of the forceps. It supplies from below the force which is lacking from above, and our art enables us to apply this traction to the best advantage. How much traction may safely be applied is hard to say. Attempts to measure it with dynamometers have failed. It is rarely necessary to pull with more than the strength of the biceps, as in Fig. 360. To brace the feet against the table and pull with all the strength of the back and shoulders is brutal, unscientific, and murderous. Craniotomy is more humane. The accoucheur should always remember, when working with the forceps, that he has a child's brain in the grasp of a powerful vise, and that only the greatest care and gentleness will save its wonderfully delicate structure from injury.

**Indications for Forceps.**—These are the same as for extraction in general, comprising those conditions which threaten the life of the mother or child. Some accoucheurs apply the forceps as soon as the head reaches the perineum, with the sole object of saving the woman the pain of the second stage. This practice is to be deprecated, but at the same time it is cruel to allow the woman to remain many hours in the second stage, waiting for signs of actual danger to the mother or child, when the accoucheur is convinced that she will not be able to deliver herself. As Barnes said, we should wait to see what the woman is able to accomplish, not what she can endure. Then, too, when the signs of danger to the mother or the child are present, often real damage has been done—it were wiser if the accoucheur had anticipated the dangers. In America, 75 per cent. of the forceps operations are done because of insufficiency of the powers of labor when the head has come onto the perineum or even is visible during a pain. Either the head is a little too large, or the perineum a little too resistant, or the woman's nerves have given out. In either case labor has come to a standstill, the pains weaken, the woman bears down less and less strongly, and, if not relieved, may get into a highly nervous, even delirious condition, which is not without after-effects on her constitution. The child suffers too, the heart-tones are slowed, then grow faster and irregular, and a caput succedaneum forms and soon attains large dimensions and hardness.

It is not easy to select just the right time to interfere in these cases. Needless to say, the conditions must all be fulfilled. In general, it is wise to operate long before the exhaustion is marked, before the signs and symptoms of threatened rupture of the uterus are present, and before the child presents evidences of asphyxia. It is impossible to assign an arbitrary limit, but in my own practice, when the head has come well down onto the perineum and makes no progress for two and one-half to three hours, I usually interfere. If the perineum seems to be too resistant, a deep episiotomy may allow the head to go through—a procedure which is much preferable to forceps. If episiotomy does not give exit to the head, nothing has been lost, because the perineum would probably have been incised for the

succeeding delivery anyway. I believe that the forceps operation, combined with deep episiotomy, will spare the child the dangers of prolonged cerebral compression, and thus prevent subsequent cerebral diseases.

Arrest of the rotation of the head is another frequent indication for forceps. Occipitoposterior positions are most often here concerned, the occiput not turning completely to the front, but stopping, usually in the transverse diameter of the pelvis—the so-called *deep transverse arrest*. It is not uncommon to find the child in the “military attitude,” that is, one of slight deflexion, with the head set squarely on the shoulders. The sagittal suture runs across the pelvis, the two fontanelles being about on one level.

Third in frequency may be grouped a large number of complications which affect the mother, but secondarily, the child also, a few of which may be mentioned. Eclampsia, fever, or infection during labor, with or without tympania uteri; acute diseases, as pneumonia, typhoid; chronic diseases, tuberculosis, heart disease, with the possibility of hemoptysis, heart failure, or edema of the lungs; hernia, appendicitis, and other intra-abdominal conditions; placenta prævia, abruptio placentæ, prolapse of the cord, etc.

Face and brow presentations *per se* do not indicate forceps or any interference, but the accoucheur is oftener called upon to intervene.

Contracted pelvis of itself is really a contraindication for forceps. Schröder says they fit the contracted pelvis like the fist on one's eye. After the head is molded so that it is almost ready to come down into the excavation, and in cases of generally contracted pelvis, where the powers give out after the head has engaged, it is justifiable to use the forceps as an instrument of trial, but the accoucheur must be constantly aware of their murderous possibilities.

Finally may be mentioned the use of forceps on the after-coming head, a practice which should, in my opinion, supersede many of the difficult Smellie-Veit extractions.

**Conditions for Forceps.**—These are the same as for extraction in general. (1) The pelvis must be large enough to permit delivery of the un mutilated child. If this point cannot be settled beforehand, the forceps, if used, is only an instrument of trial—of diagnosis. Forceps may not be used on a hydrocephalus, since the blades will usually slip off. If the child is very small, a diminutive pair of forceps is to be employed. (2) The cervix must be effaced and dilated, or sufficient enlargement must be easily procurable. Dilatation of the cervix by means of the head pulled down by forceps is a dangerous—really unjustifiable—procedure. (3) The membranes must be ruptured and out of the way, because of the danger of dislocation of the placenta. (4) The head must be engaged, or so nearly so that a cautious trial of the forceps may be permissible. (5) The child must be living. If the fetus is dead, craniotomy should be performed; if in doubt, the forceps.

**Technic.**—We speak of “high,” “low,” and “medium” forceps, but there is no uniformity of teaching as to what these terms mean. It would be better to designate the operation by the name of the plane in which the biparietal diameter is found, for example, *outlet* (for low), *midplane* (for medium or mid), when the parietal bosses lie in the bispinous line, and *inlet* forceps (for the term high when the head lies in the plane of the inlet, but has not yet completely engaged. To apply the forceps on the floating head is usually a lapsus artis.

A few commonly used expressions require explanation. The “front” of the forceps is the side of the concavity, the side on which the lock opens, and to which the tips of the blades point. The forceps may lie in the pelvis in any of its diameters. The forceps is said “to lie in this or that diameter” when a line drawn through the centers of the fenestra lies in the diameter specified. The front of the forceps therefore, would look in the diameter at right angles to the one the forceps lie in. The best diameter for the forceps to take is the transverse, because then their pelvic



curve corresponds to the mother's pelvic curve. The child's head is said "to lie on this or that diameter" of the pelvis when the sagittal suture lies in that diameter. When the head lies in the anteroposterior diameter and the forceps lies in the transverse, the head will be grasped in the most favorable manner, and the delivery of

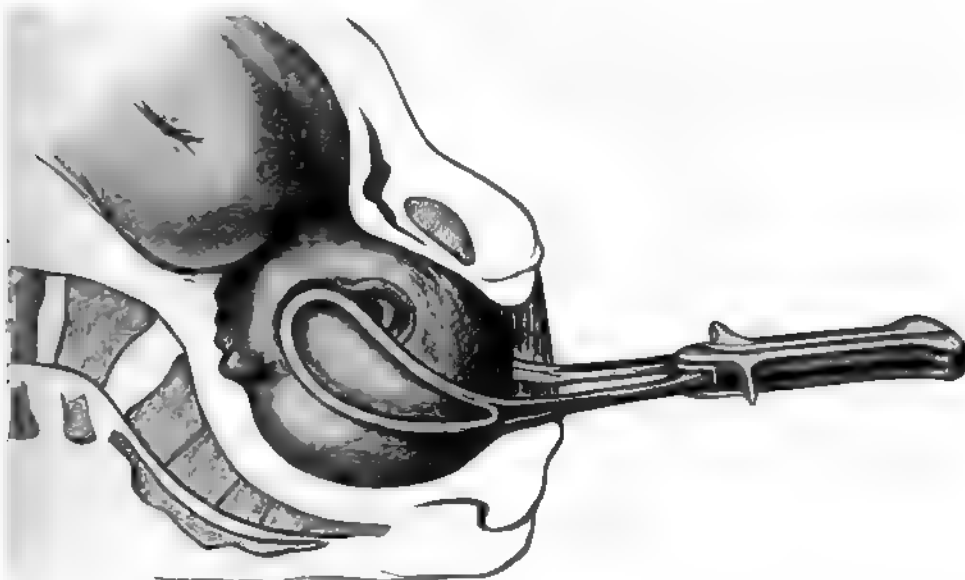


FIG. 853.—THE FORCEPS LYING IN THEIR MOST FAVORABLE POSITION.  
The head is on the perineum and rotation is complete.



FIG. 854.—FORCEPS IN O.D.A.  
The forceps lie in the right oblique diameter of pelvis.

the child will be attended with the least difficulty (Fig. 853). When the head lies in an oblique diameter of the pelvis, the forceps should be applied in the opposite diameter, the front of the forceps pointing in the direction in which the point of direction lies (Fig. 854). Some operators still place the blades in the sides of the

pelvis, that is, in the transverse diameter, letting them grasp the head whichever way they will. Other operators apply the blades to the sides of the head. When the child's head lies with its long diameter transversely in the pelvis, the only way the forceps can get a good hold on it is when they lie in the anteroposterior direction, but then one blade would rest on the promontory while the anterior one would cut into the bladder, the curves of the forceps and of pelvis antagonizing each other. In such cases a compromise must be made, and the blades are laid in one oblique of the pelvis and grasp the child's head over one malar bone and the opposite par-



FIG. 856. FORCEPS GRASPING HEAD IN AN UNFAVORABLE DIRECTION. This is a strong tendency to slip. This application to be avoided if possible.

(Fig. 856). This is better than to place the blades one over the face and the other over the occiput, the instrument lying in the transverse as in Fig. 855. If the head is excessively flexed, this last is not so objectionable. The application of the forceps to the head, not to the pelvis, is the original method taught by Levin. Since then it has become more scientific, yet not invariably feasible.

Another of the more important points, which there are no exceptions is that the oblique of the forceps must be in the direction of the point of direction. If the occiput is on the right side of the pelvis, the front of the forceps points to the right; as the occiput rotates to the front, the front of the forceps looks more and more for

Of the two blades, the left is, with rare exceptions, passed first; it is grasped ~~in~~ the left hand and laid in the left side of the mother. The right blade is held by ~~the~~ the right hand, and comes to lie in the right side of the pelvis.

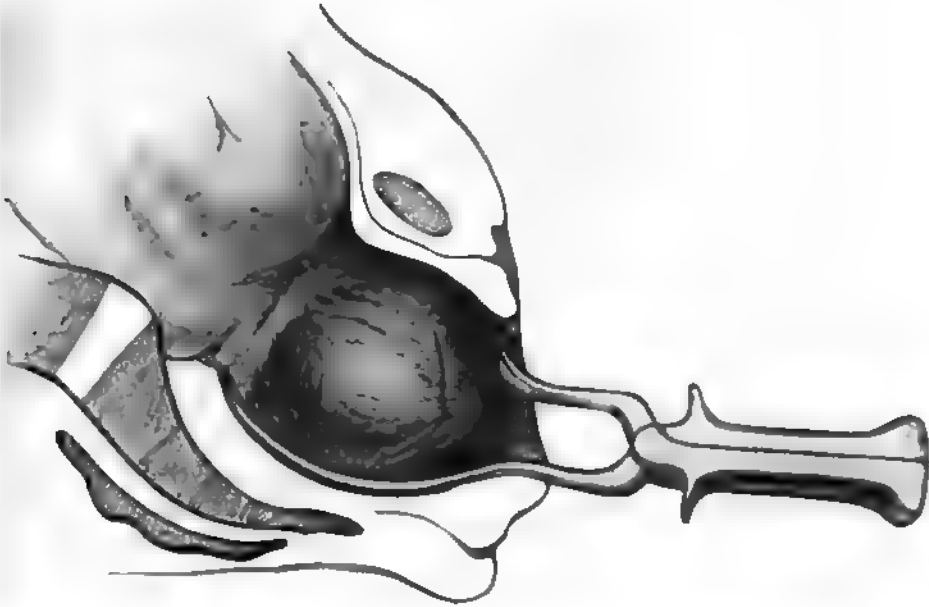


FIG. 856.—FORCEPS IN O.D.T.

The head lies in the transverse, the forceps lie in the right oblique. The front of the forceps points to the right anterior.

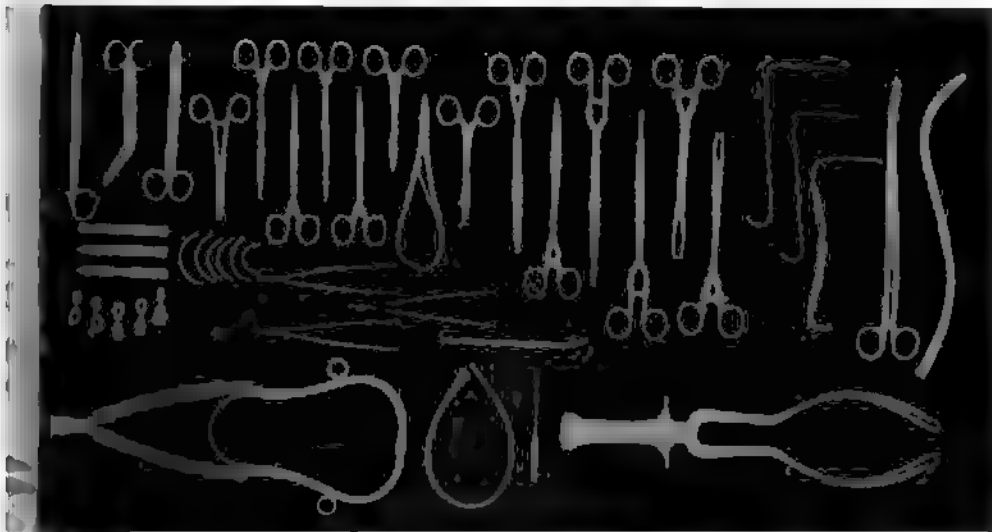


FIG. 857. INSTRUMENTS FOR FORCEPS OPERATION

Obstetric forceps; 6 artery clamps; 3 scissors; 3 retractors; 2 needle-holders; 6 needles; 2 vulsellum forceps; 2 ~~ing~~ cervix forceps; 2 tissue forceps; uterine packing forceps; tracheal catheters; stethoscope; female catheter; ~~and~~ solution needle; silk-worm-gut, catgut, etc.

Every forceps operation consists of four acts—application of the blades; adaptation or locking; extraction of the head; removal of the instrument. The preparations for the operation have already been discussed. Fig. 857 shows the instruments needed.

*First Act—Application of Blades to Head.*—Having reassured himself the diagnosis is correct by a careful examination after the patient is asleep and the accoucheur seats himself on a chair of convenient height and rehearses the intended operation in the air before the patient. Two fingers of the right hand passed into the vulva, vagina, and, if the cervix can be reached, inside the and within the membranes. Nothing may lie between the forceps and the and, to be certain of this, the fingers must feel the head all the way and be up as high as possible, guarding the tip of the forceps until it goes beyond. In higher forceps operations the half hand should be inserted. Now the left of the forceps is taken in the left hand, poised vertically in the introitus va



FIG. 858.—GRASPING BLADE LIKE A PEN, FIRST MOTION. INSERTION OF SECOND BLADE.

being held like a pen (Fig. 858), and passed with the delicacy of a urethral s. As the blade glides along the fingers in the vagina the tip is held closely to the so as to get under the cord or the membranes if they should fall in the way. thumb of the left hand is used to guide and press the blade into place. As the trum disappears inside the vulva, the time is come to sink the handle, and wh lock rests near the perineum, the first half of this act is completed. In most fo operations, if properly applied, the blades will fall into the right position of own weight. As the handle sinks down, the operating hand glides over the to now grasps it like a scalpel (Fig. 859). It is not good to hold the forceps l catlin in the whole fist.

The right blade is passed in like manner, the two fingers of the left hand being inserted and acting as guide and protectors of the maternal tissues. The lock being on the top of the left blade, this one must be passed first, otherwise the handles would have to be recrossed outside the vulva, after the application, which would subject the maternal tissues and the child to injury by the tips of the instrument and allow the cord to fall into the grasp of the blades.

*Second Act—Adaptation or Locking.*—The technic of this movement will depend on the presentation and position of the head, since the blades must be applied so as to fit it in the best way.

In the usual operation of forceps the head is low down, and the small fontanel has rotated all the way or nearly all the way to the front, and the blades, after being inserted, fit naturally to the sides of the head. Often, however, they need a little adjusting before it is possible to fit the lock neatly. The simplest method to bring the blades into position is to press the handles gently downward onto the perineum. If this is not successful, they are depressed, and at the same time twisted lightly by means of the hooks on the handles, and if this does not do, a triplex motion is given the instrument. The handles are pressed downward, pushed upward into the pelvis, and twisted slightly, all in one movement, but *without the exhibition of much force*. If it does not succeed easily, the forceps must be removed and re-applied, because there is some obstacle to locking, which must be recognized and relieved. To force the locking is bad practice, and always results in fetal or ma-

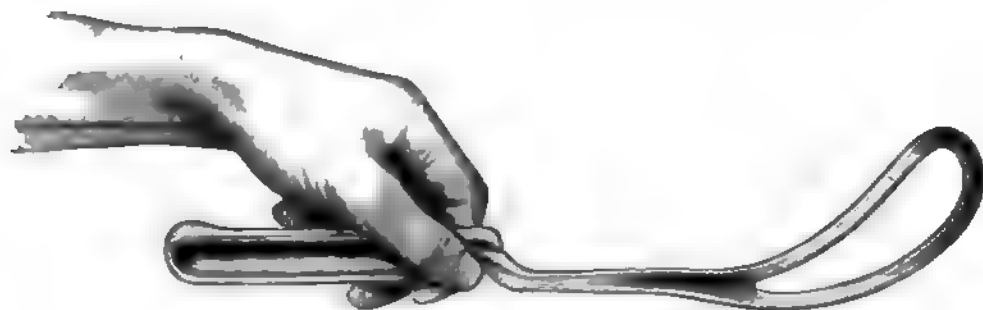


FIG. 869.—GRASPING FORCEPS BLADE LIKE A SCALPEL. SECOND MOTION OF INSERTION.

ternal injury. Usually the accoucheur will find he has made an error in diagnosis or that the child has a hydrocephalus.

After locking, the heart-tones should be auscultated. First listen and note their frequency and strength, then close the blades and listen again. If the tones at once become faint or slow, the cord is in the grasp of the forceps; if the slowing occurs only when the handles are kept tightly closed, it is due to cerebral compression. By pushing one or two fingers up along the back of the child's neck, behind the pubis, it is possible to feel the cord if it encircles the neck. Should there be a suspicion that the tip of the forceps squeezes the cord, the instrument must be removed and reapplied. If compression of the cord is unavoidable, the delivery must be quickly effected. An internal examination is also made to find if the cord or cervix or an arm is caught in the grasp of the instrument.

*Third Act—Extraction.*—After locking the forceps one gentle pull is made on them to see if the blades lie properly and fit well, also to give the accoucheur an idea of the amount of resistance likely to be met. This is called the trial traction, and after it is made the heart-tones should again be listened to. Four points must be borne in mind with each traction: (1) Each traction is made with the uterine pains, and if these are absent, the pain is imitated, that is, the pull is gradual at first, slowly reaches an acme, is held for a moment, and then slowly relaxed; (2) as little power is exhibited as possible, regulating the amount by the advance of the head. With

the elbows at the side and the arms flexed the strength of the biceps alone should suffice, and more than 60 pounds will almost never be required—less. Time should be disregarded, but the fetal heart-tones carefully watched (3) with the single exception soon to be considered the traction should not be combined with pendulum, corkscrew, nor twisting motions, & the traction should correspond to the axis of the parturient canal.

After the trial traction the forceps are grasped, as shown in Fig. 860, in the hand over the lock, with the little finger between the shoulders of the blades, the left hand on the handles, both thumbs underneath. One slow traction is made, at first in the horizontal plane or downward, or somewhat upward, depending on the station of the head and the curve of the parturient canal at that particular point. Carefully note the amount of progress of the head, and

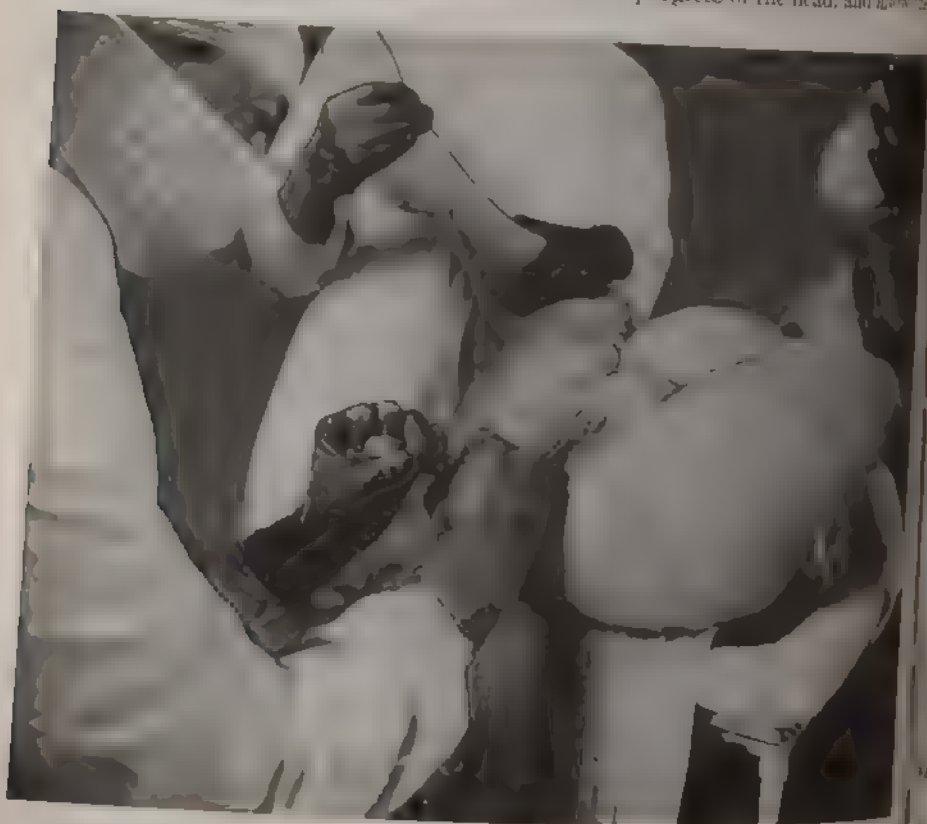


FIG. 860.—SHOWING POSTURE OF OPERATOR FOR TRACTION

head to recede very slowly; then listen to the heart-tones, loosening the forceps after each traction, but not separating the handles too far, because the blades may slip under the blades. After one or two full minutes by a clock placed in front of the operator, another traction is made—if necessary, a little stronger than the first. The descent and rotation of the head are determined by firm retractions, the fingers searching for the location of the small fontanel. As the head bulges the perineum traction is more upward, and the usual precautions for the pelvic floor are to be observed, such as slow delivery, bringing the head out with its most favorable diameters, and episiotomy. In my own practice I have delivered a primipara with forceps without first doing an episiotomy. This saves the child's head from prolonged compression, shortens the time of operation, prevents fetal asphyxia, and prevents a ragged laceration, which is almost inevitable.

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### FORCEPS IN THE UNUSUAL MECHANISMS OF OCCIPITAL PRESENTATION

**Deep Transverse Arrest.**—In some cases where a delay in labor has been manifest for some time an examination reveals the head well down in the pelvis, the sagittal suture in the transverse diameter, the small fontanel to one side, generally the right, the large fontanel to the other side, and both on the same level. This condition is called "deep transverse arrest"—sometimes "impaction," the head being wedged in between the ischial tuberosities. (See Deflexion Attitude, p. 601.) When an indication for the termination of labor arises at a time when

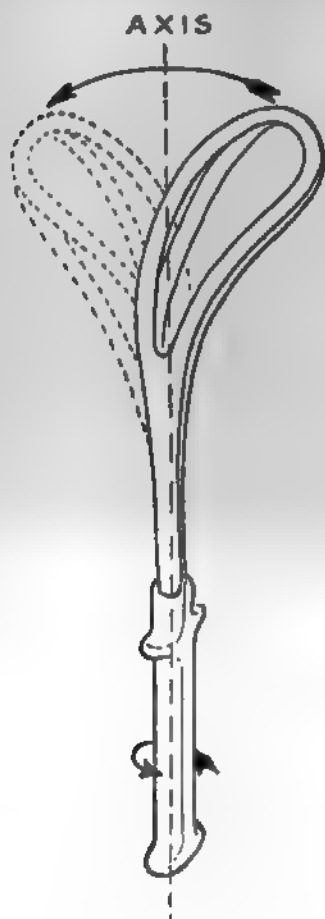


FIG. 862.

If handles are twisted, the blades tend to describe an arc in the pelvis, tearing the vagina from its attachments.

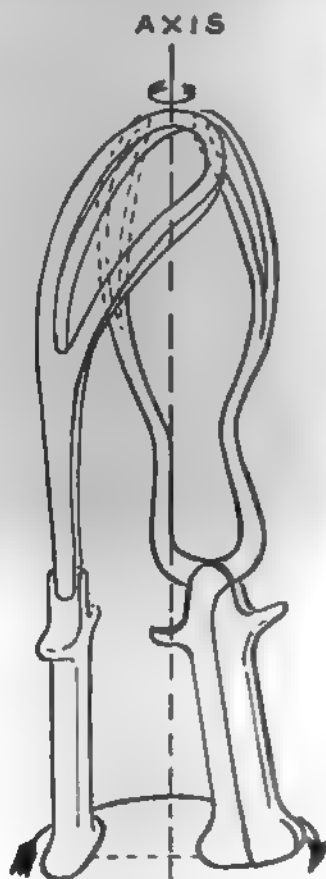


FIG. 863.

If we wish to give a rotatory movement to the blades, the handles should be made to describe an arc.

rotation of the occiput is not yet complete, two objects are to be accomplished: first, rotation must be completed; second, extraction is to be made. Some American and French operators turn the head around in the pelvis with the forceps, and twist the head through an arc of over 135 degrees. The author does not recommend this practice. The lacerations of the vagina and the avulsion of the bladder and the vagina from their bony attachments are too great. It is allowable to give the head the same turbinal or spiral movement it takes in nature, but the accoucheur must be aware that we are but poor imitators of nature, and even with the greatest care deep injuries are often inflicted. Fig. 862 shows the effect of twisting the for-

ceps, and Fig. 863 how the handles should be swung through a segment of an arc, if we wish to impart a rotatory movement to the head within the pelvis. This

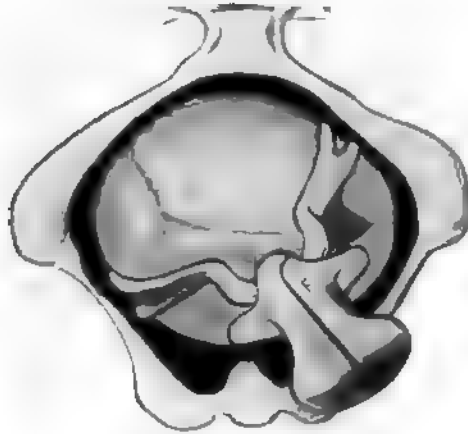


FIG. 864.—DIAGRAM OF FORCEPS IN O.D.T.  
F indicates front of forceps.



FIG. 865.—FORCEPS APPLIED IN O.D.T. READY FOR TRACTION.

rotation of the handles of the forceps must be combined with the pull, or traction, and the two motions are to be absolutely synchronous—never rotation without progressing traction.



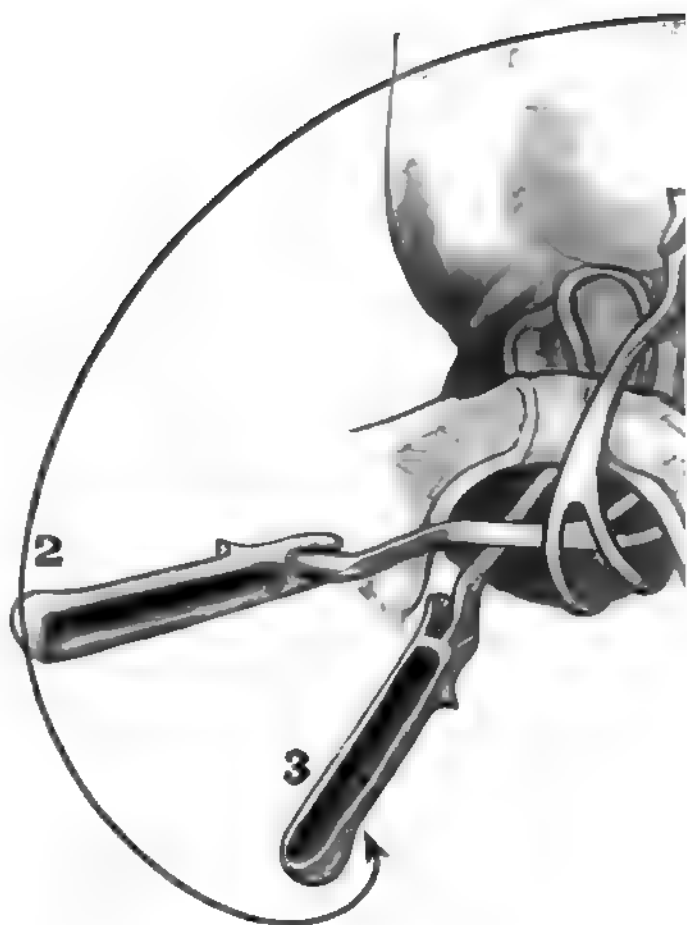


FIG. 856.—ROTATING LEFT BLADE AROUND HEAD IN O.D.T.

posteriorly, opposite the right sacro-iliac joint, lying on the posterior parietal bone. The left blade, therefore, has to be guided around the side of the pelvis over the child's face, to come into position, (Figs. 866 and 867), while the right blade does not have to "wander" at all, but may be laid directly opposite the sacro-iliac joint. While the blade is being pushed in by the outside hand, the fingers inside pull it around the pelvis. Locking is not easy in these cases, but is done as before described, and the operator, knowing that the head is grasped in one of its long diameters, will not bring the handles too close together. A good way for the accoucheur to assure himself that the child's head does not suffer injurious pressure is for him to put the index-finger of his left hand between the handles while making traction. Extraction is accompanied by slight and gentle rotation, the two movements being absolutely synchronous, producing a turbinal or spiral rotation (Fig. 868). The front of the forceps points to the right, and the turbinal movement imparted to the instrument is from right to left and from above downward, opposite



FIG. 867.—SHOWING HOW TO TURN FORCEPS BLADE.

that shown in Fig. 868, which is for O.L.T. At the same time the force applied is so directed that the tractive impulse is first felt on the parietal bone lying posteriorly. It is difficult to describe this delicate operation, because this is the art of the accoucheur, and is attainable only by practice. The first traction should be simply downward, to see if rotation will not take place inside the forceps, which not seldom occurs. If there is no tendency for this, the second traction is combined with rotation, from right to left, so as to bring the occiput around to the front. After a little rotation has taken place, which is discovered by frequent examinations, the small fontanel being the landmark, the blades are opened and allowed to rest at the sides of the head. A few pains may complete the process. As rotation occurs the blades are readapted so as to lie more and more on the sides of the head, and as the instrument grasps the head in more favorable diameters, the handles come closer and closer together. If the fetal heart-tones are good, time may be

disregarded. After rotation is complete the forceps may be removed and the case left to nature. This is often desirable in primiparae with rigid parts and large babies.

If the pains are strong, the head is properly molded within a few hours, and the subsequent low forceps operation, if it becomes necessary, is much easier. Many object to this "two-stage" forceps operation, as subjecting the parturient to two anesthetics, and because, when she awakens, she is disappointed not to have been delivered, also on the score of the consumption of time and the increase of trouble

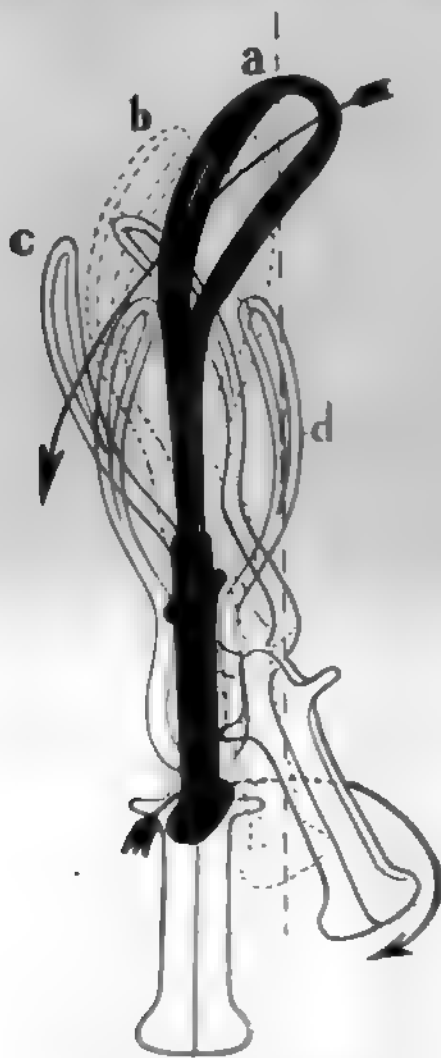


FIG. 288.—TERMINAL MOTION OF THE FORCEPS.  
This is as applied to a head in O.L.T.

on the part of the accoucheur and nurses, but extensive experience has convinced me that the benefits resulting—absence of lacerations, avoidance of fetal injury and asphyxia, and ease of subsequent operation—often offset the disadvantages. Naturally, one may wait only when there is no indication for the immediate termination of labor.

If the delivery must be completed at once after the small fontanel comes to the front, the rest of the operation is the same as was described under Low Forceps.

**Forceps in Occipitoposterior Positions.**—The reader is referred to p. 600 for details of treatment of occipitoposterior positions. Since the forceps operation may be considered at all, it means that the head has engaged, and that, in spite of strong pains, or eventually in spite of the procedures of rectification before mentioned, the occiput remains persistently posterior. I have very seldom found it necessary to apply the forceps to an occipitoposterior as such, and these cases were almost always those where the head was fast on the pelvic floor, the small fontanel pointing to the sacrum, and manual correction impossible. Under such circumstances the occiput must be delivered over the perineum, and, as will be seen if reference is made to the chapter devoted to the Mechanism of Occipito-posteriors, it is best to deliver the head in extreme flexion. Some operators use for this purpose straight forceps without pelvic curve, since they allow a better grasp over the parietal bosses, but my experience shows that the advantage is not great enough to induce one to have a pair.

The application of the blades is made as usual, but the front of the forceps looks toward the forehead, which, from now on, becomes the point of direction (Fig. 869). Locking the blades is the same as usual, but after they are locked the

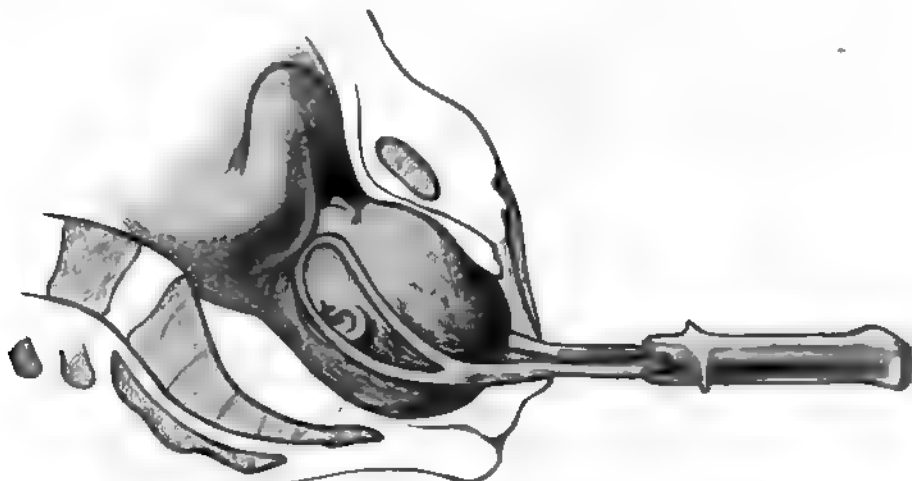


FIG. 869.—FORCEPS IN OCCIPUT POSTERIOR POSITION ON PELVIC FLOOR.

handles are raised a little toward the pubis—this to increase flexion. Traction is made on the parietal bosses, a little upward from the horizontal plane. This increases flexion, and it has happened, though I have never observed it, that even as late as this anterior rotation has occurred. The occiput is first delivered over the perineum, the forehead resting behind the pubis; then the brow and face come from under the pubis. Much power is often necessary, and it is advisable to perform episiotomy in primiparæ, as a rule, and almost always in multiparæ, to avoid extensive lacerations of the pelvic floor and sphincter. If conditions are favorable one might deflex the head and deliver as a face presentation.

When it becomes necessary to apply forceps with the occiput in a position between the transverse diameter and the hollow of the sacrum, great difficulties are met, and the operation should not be lightly undertaken. I am convinced that ten times the number of babies are lost from this complication in the United States than from contracted pelvis. It is often possible, by combined manipulation, to rotate the head into the anterior quadrant of the pelvis, or at least into the transverse, and hold it there until the forceps can be applied, which very much simplifies the operation. If this is impossible, the forceps are applied in the transverse diameter of the pelvis, and traction made in the horizontal plane, no attempt at rotation being practised, the object being to observe and discover the mechanism in-

tended by nature. If the occiput comes down, flexion is increased and some anterior rotation occurs. If it is noticed that nature intends this mechanism, the forceps are opened and reapplied in a manner to favor the indicated mechanism, the process being repeated at intervals as the small fontanel turns toward the pubis. If, on the contrary, the occiput should show a tendency to rotate posteriorly, no attempt should be made to hinder this. To force the rotation into an anterior position would seldom succeed, and there is great danger of tearing the soft parts. The accoucheur should be guided by what he finds nature is intending to do, and should aid that mechanism. It may be necessary to remove and reapply the forceps three or four times to accommodate the different positions which the head takes in passage. Some accoucheurs prefer the axis-traction forceps for these cases on this account, but for the man who knows the mechanism of labor and is willing to be guided by the action of the natural powers they are unnecessary, and in the hands of a man ignorant of the principles of the science of obstetrics the instrument is too dangerous.

**Scanzoni-Fritch Method.**—Williams speaks very highly of this method of

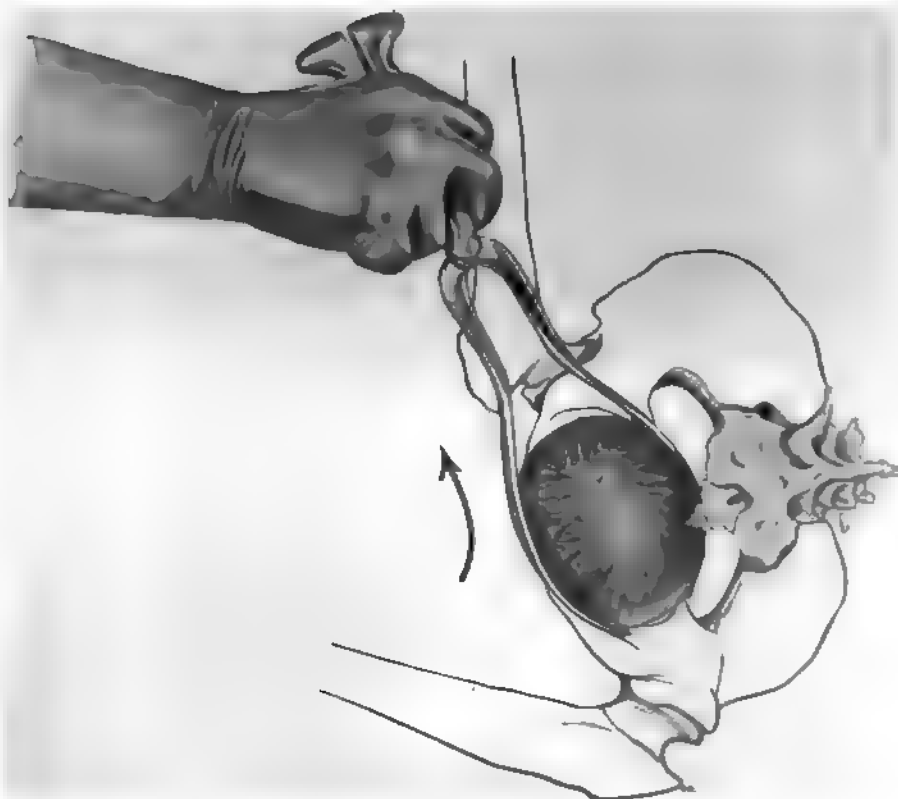


FIG. 569a.—DELIVERY OF THE HEAD OVER THE UPPER RAMUS PUBIS.  
This method is used in cases of ankylosis of one hip and rarely when rotation is impossible.

forceps delivery, but in a not small experience I have used it only thrice, and then merely to try it. It is entirely dispensable, and, in my opinion, is fraught with too great dangers to the maternal soft parts and of Erb's paralysis, to be practised by any but experts. The forceps are applied with the front looking toward the forehead. By rotating the instrument the forehead is brought to the rear, which, of course, inverts the forceps. They are removed and reapplied, with the front toward the occiput, which has come to the pubis, and the operation is completed as usual.

after rotation has occurred. Jaggard taught that it is too dangerous to rotate the head through an arc exceeding one-fourth of a circle, and my experience convinces me that he was right.

**Forceps in Face Presentations.**—*Per se* face presentation is no indication for forceps, but labor is often delayed and help often required with all the deflexion attitudes. In face presentation, to the conditions demanded for forceps in general one new one must be added—the chin may not be behind the transverse diameter of the pelvis—that is, anterior rotation of the chin, at least to the transverse diameter, must have occurred. The forceps operation otherwise is usually equivalent to a craniotomy.

*Application of the blades after the chin has rotated* is very easy, although care is required not to injure the baby's eyes. Adaptation or locking is different. Instead of depressing the handles, it is best to raise them well. This sinks the blades toward the hollow of the sacrum, and thus they obtain a firmer hold over the parietal bosses. If the blades are placed and locked in the usual manner, they will slip off the narrow brow and face—they are, therefore, locked with the handles raised, and the latter are lowered, which maneuver increases extension (Fig. 870). Traction is first downward, to increase deflexion, then in the horizontal plane, until the chin is well out from under the pubis, then upward, but not so acutely as with the occiput, because the delicate larynx is between the spine of the child and the bone. Episiotomy is the rule in primiparæ.

**Forceps in Arrested Rotation of the Chin.**—To deliver with forceps when the

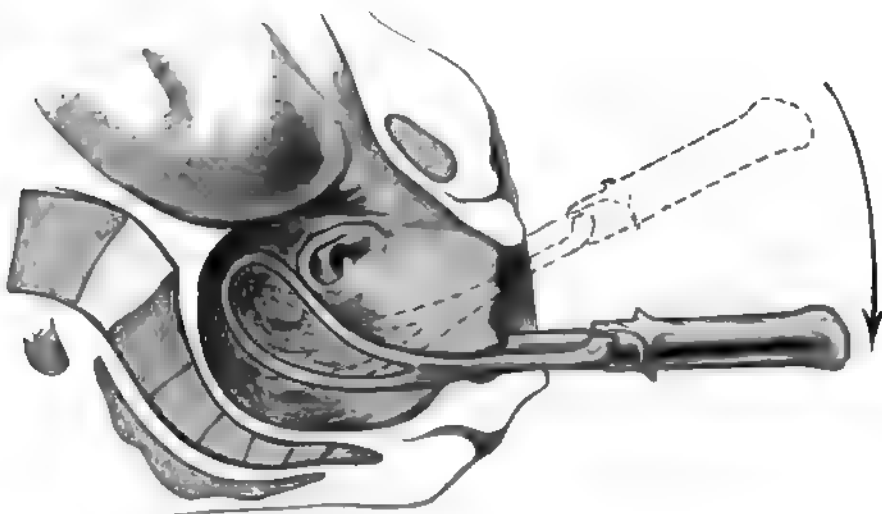


FIG. 870.—FORCEPS IN FACE PRESENTATION.

Dotted line shows forceps as first applied. Traction is applied after handles are lowered.

chin is directed toward the hollow of the sacrum is possible only when the child is small, and then only at the expense of extensive lacerations. To try to rotate the chin anteriorly by means of forceps from a posterior quadrant of the pelvis is equivalent to a craniotomy, and much more damaging to the mother's tissues. It is, however, possible safely to deliver a face presentation arrested in rotation after the chin has reached or passed the transverse diameter, but the operation is very delicate, very difficult, usually causes deep tears, and often costs the child's life. The reason for the last is obvious. One blade compresses the neck and always injures the structures exposed by the extreme extension of the cervical spine. The forceps lie in an oblique, the front pointing in the direction of the point of direction.



For deliveries begun when the head is above the level of the spines of the ischia, many authors recommend a special instrument,—the axis-traction forceps,—that

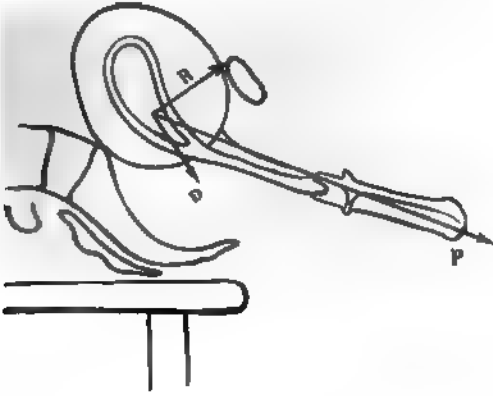


FIG. 872.—DIAGRAM SHOWING TRACTION WITH USUAL FORCEPS.

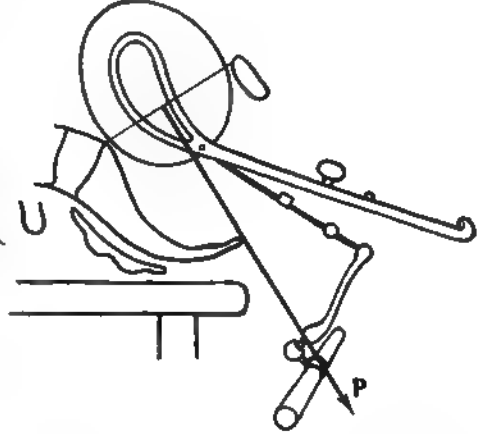


FIG. 873.—DIAGRAM OF ACTION OF AXIS-TRACTION FORCEPS.



FIG. 874.—PAJOT'S (OSLANDER'S) MANEUVER WITH FORCEPS.  
By this method axis-traction is obtained.

is, an instrument which will enable us to apply force to the head parallel to the axis of the pelvis.

The head, when high up, has a curve to traverse. Owing to the forward projection of the sacrum and perineum, traction cannot easily be applied in the axis of



the inlet. If applied in any other line, the problem is like trying to pull an object around a corner—both the corner and the object suffer.

Fig. 572 shows the effect of the ordinary forceps when applied on the high head; if traction is made in the usual way, a large part, estimated by Tarnier as almost half, of the force will be exerted against the symphysis. The older obstetricians appreciated the fact that the head would thus impinge on the anterior pelvic wall, and Levret (1750) recommended that tapes be put through the fenestra of the forceps, and, while pulling in the usual manner, also to pull downward on the tapes, thus making the head follow the curve of the parturient canal. Oslander (1898)

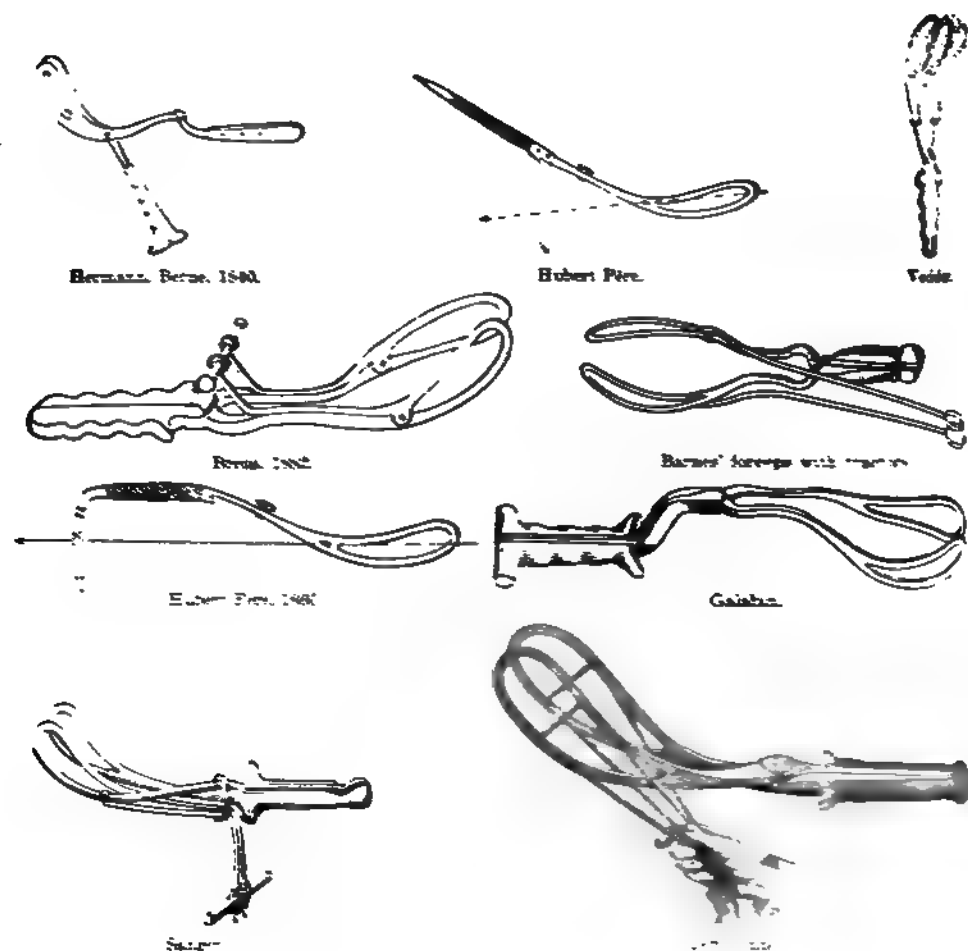


FIG. 572.—THE DESIGN OF OBSTETRICAL FORCEPS.

advised to pull in a downward direction, and the force will be exerted against the symphysis. The older obstetricians appreciated the fact that the head would thus impinge on the anterior pelvic wall, and Levret (1750) recommended that tapes be put through the fenestra of the forceps, and, while pulling in the usual manner, also to pull downward on the tapes, thus making the head follow the curve of the parturient canal. Oslander (1898)

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enna is lukewarm, and Bossi, in Genoa, says they are entirely dispensable. For my part I cannot share the enthusiasm of Williams, Kerr, Murray, and others. By means of the Oslander maneuver I can give the head a direction which a knowledge of the mechanism of labor will dictate; by careful observance of the tendencies of movement which the forces of nature give the aid I can determine in which way to apply traction, and I can aid one or the other, as required. With the axis-traction device there are so many joints between the operating hand and the head that it is impossible to impress on the latter any specific motion. All the knowledge one has accumulated regarding normal and abnormal labor mechanisms goes for naught, and all one can do is to pull blindly on the cross-bar. In this respect the axis-traction forceps are not artistic. In actual practice, where I have applied both instruments on the same case, I have been better satisfied with the simple Simpson forceps and seldom use any other. Deep injuries to the maternal tissues are just as frequent with the new forceps, a fact which W. A. Freund proved. The Tarnier instrument has a murderous cephalic curve, cognizance of which should be taken when screwing together the handles, otherwise a large number of dead and injured children will be the result. In all axis-traction instruments there is the possibility of the curved arms or the joints bending or breaking under the powerful force applied, having witnessed three such accidents myself.



FIG. 876.—TARNIER AXIS-TRACTION FORCEPS. LAST MODEL.

*Indications for High Forceps.*—These are the same as usual—danger to the mother or child, occurring at a time when the head has not yet passed through the inlet. Let it be well emphasized that the indication for forceps here must be unusually strict.

*Conditions.*—These also are as usual, and to be strictly insisted on. Engagement of the head must be so nearly accomplished that the accoucheur feels certain that a little pull from below will help the head into the pelvis, which means that holding of the head be well advanced. He must remember the alternative if he fails—craniotomy or hebostomy. The pelvis may not be too contracted—not less than  $8\frac{1}{2}$  cm. in flat and 9 cm. in the justminor types. Dilatation of the cervix and retraction of the pelvic organs above the inlet must be positively complete.

The operation itself is quite a little more complicated than the low or midplane forceps, but the principles are identical. In applying the blades the half or even the whole hand should be inserted as a guide. Adaptation of the blades must be

to the sides of the pelvis, because the instrument, being pushed in so far, must its pelvic curve correspond to that of the pelvis. The head, therefore, is grasped in the sagittal diameter, especially in flat pelvis, where the head enters the transverse diameter, and one blade will lie over the occiput, the other over the face (Fig. 877). To prevent serious injury of the child the handles may be tightly screwed together. In using the ordinary forceps a finger is laid between the handles. Locking is more difficult and is done as usual. No force may be employed and the hand outside may help adjust the forceps, the tops of whose blades may be manipulated above the pubis. Before articulating the blades it may be nec-

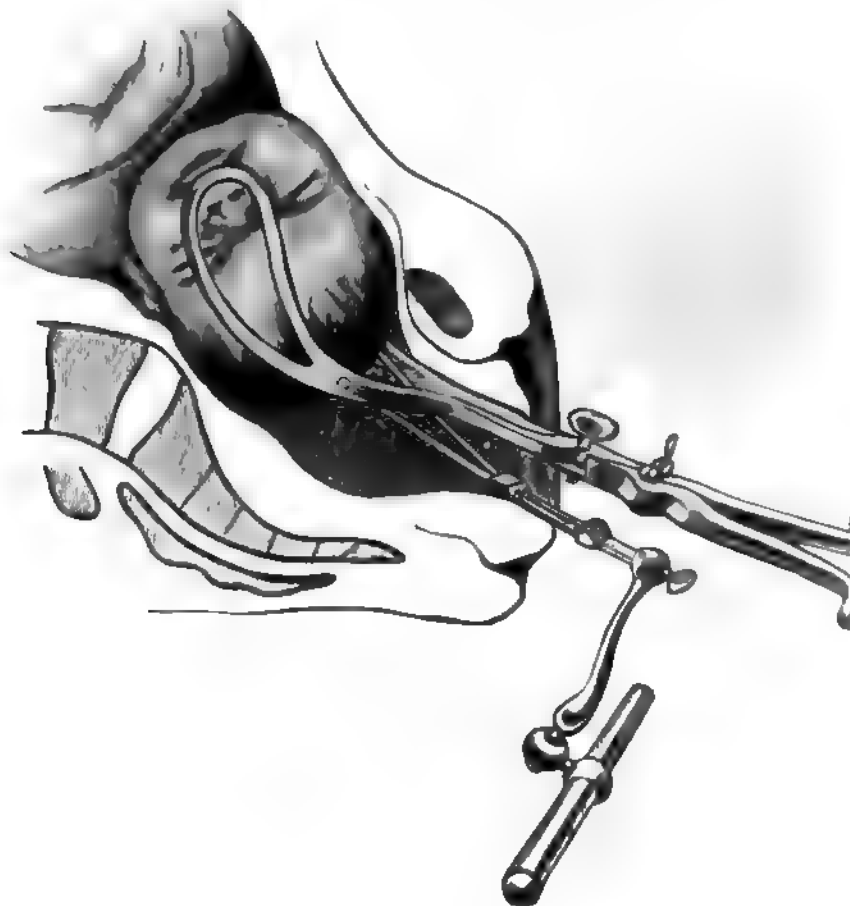


FIG. 877.—AXIS-TRACTION FORCEPS APPLIED AT THE INLET.

to adjust the head to the pelvis by combined manipulation. In extracting to be remembered that the high forceps is an operation of trial—of diagnosis. Traction should be made, according to Tarnier, in the direction indicated by the handles, the traction rods lying 1 cm. away from the shanks (Fig. 877). If at most eight, powerful, well-directed tractions make no impression,—do not move the head lower,—the instrument must be removed. Two or three of the tractions should be made with the patient in the Walcher position. Craniotomy now may be done, or if the mother and babe are in prime condition and the environment favorable, hebosteotomy or extraperitoneal cesarean section. If the head moves a little with each traction, the operation should be gently completed. Plenty of time. After the head has entered the pelvis it may rotate within the

forceps, which should be opened to permit this, or it may be turned by combined manipulation, the case now being simply one of arrest at the midplane. Now remove the axis-traction apparatus and deliver as in ordinary forceps, or it may be best to leave the delivery to nature, or to follow a subsequent indication.

**Prognosis of the Forceps Operation.**—For the mother, the dangers are injury, hemorrhage, and infection. Some tearing of the pelvic organs is inevitable, and the number and severity increase the higher up the forceps operation is done. High forceps show the most and the worst injuries, which may be atrocious if the condition relating to the dilatation had not been fulfilled. If rotary motions with the

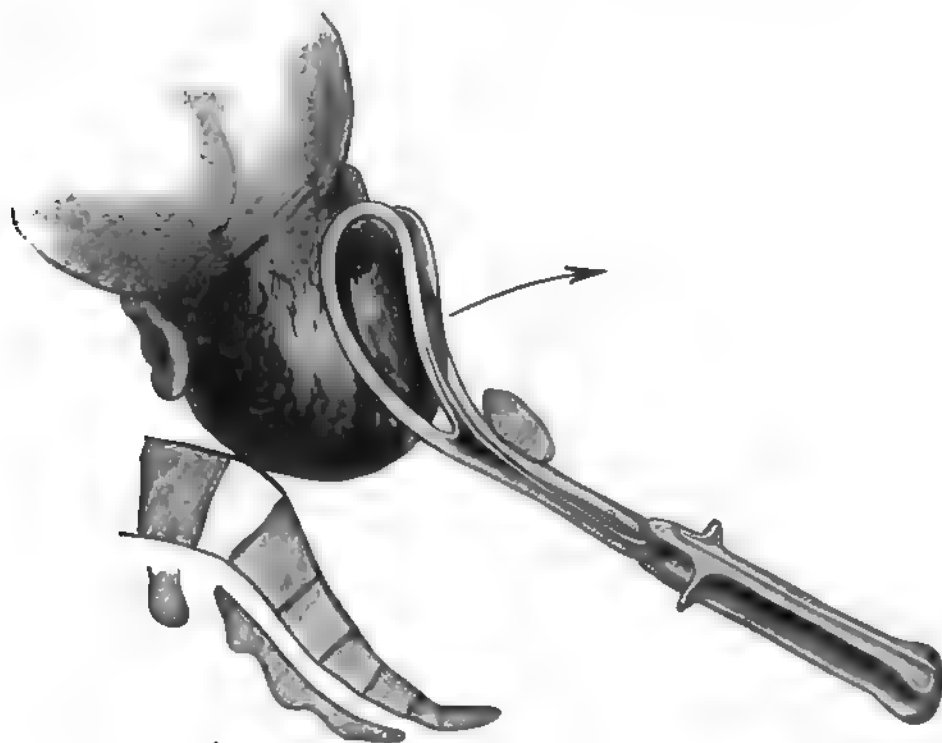


FIG. 578.—SLIPPING OF FORCEPS. HORIZONTAL SEMI. EXAXIAL.

forceps are made, the vagina may be twisted from its connective-tissue attachments, or the cervix may be caught in the grasp of the forceps and be bruised or torn off bodily; or the operator, thinking the blade is inside the cervix, may use force, and as the tip of the instrument is in the fornix, he may punch through this up, under, or through the peritoneum.

The vagina itself may be torn or cut by the blades of the forceps and the vulva also, especially when the blades are bent upward in the delivery of the head. The edges may cut the crura of the clitoris and cause severe hemorrhage, or pressure necrosis which may go to the bone. In severe forceps operations the symphysis pubis has been ruptured, also the sacro-iliac articulations, and the woman will have a pain in the lower spine and back, with more or less invalidism all the rest of her life. Injury to the sacro-iliac joints is a frequently overlooked cause of back-ache, leukorrhea, and many gynecologic conditions. The bladder may be torn into, or may be pulled off its pelvic attachments and be permanently prolapsed. Scars in the vaginal wall may distort the bladder sphincter, causing incontinence



- **asphyxia.** (2) Fracture of the skull, with or without subdural hemorrhage. (3)
- **Hemorrhage** from rupture of the sinuses at the base or from rupture of the tentorium
- **cerebelli.** (4) Concussion of the brain. (5) Crushing of the orbital plates, with retrobulbar hematoma and injury to nerves and muscles, causing squint, ptosis, etc. (6) Injury to the eyes, traumatic cataract, abruption of the choroid, corneal opacity, retinal hemorrhage, enucleation of the eye. (7) Facial paralysis, from com-



FIG. 830.—BRINGING DOWN POSTERIOR ARM IN HEAD PRESENTATION.

pression of the nerve as it comes out in front of the mastoid. Usually good prognosis. (8) Pressure necrosis of the scalp, perhaps to the bone. (9) It is said that idiocy is more frequent after forceps. (10) Cephalhematoma—usually good prognosis. (11) Compression or cutting of the umbilical cord, with asphyxia. (12) It is possible that deafness may be due to injury or hemorrhage into the organs of hearing, etc. (13) Erb's paralysis. (14) Indeed, nearly every imaginable injury has been observed, and, in general, forceps babies are more liable to infection, pneumonia, atelectasis, meningitis, hemophilia, etc.

**Dystocia Due to the Shoulders.**—If, after delivery of the head, the shoulders do not immediately follow gentle traction, applied as indicated under the conduct of normal labor, the accoucheur should make an examination with four fingers to determine the cause of delay. One or the other of the following conditions will be found: (1) The shoulders are broad and firm or the pelvis contracted; (2) they have

followed an unfavorable mechanism, the anterior shoulder being caught on the ramus pubis, or having over-rotated, and, the accoucheur not observing this, he tries to bring the shoulder-girdle down in the wrong diameter; (3) the cord is too short; (4) the chest of the child is too large (anasarca); (5) locked twins or a monster exists.

The head springs backward against the perineum, pressing this well up into the pelvis, and traction serves only to stretch the neck. Not a few children have been lost at this stage of delivery.

*Treatment.*—If the woman is conscious, she should be exhorted to bear down strongly, failing which the assistant makes a strong Kristeller expression. Now, by means of the fingers inside and the hand outside, the shoulder-girdle is rotated into the most favorable pelvic diameter—one of the obliques. Next, the accoucheur inserts four fingers of the left hand into the vagina in search of the posterior axilla, into which he puts his index, and, pulling gently, he tries to bring the posterior shoulder down into the hollow of the sacrum. This may be aided by crowding the anterior shoulder into the pelvis from above the pubis (Fig. 880). After the posterior shoulder has been brought to the perineum the hand is withdrawn and the child's head allowed to drop—even a little gentle traction may be made downward to bring the anterior shoulder under the pubic arch combined with pressure from above the pubis. If this fails, one finger is hooked into the axilla from over the back, and the anterior shoulder rotated into the opposite side of the pelvis. Combining the rotation with slight downward traction, the torso is given a spiral motion which will usually effect delivery. Excessive caution is here required because only too easily is the clavicle fractured or the cervical plexus torn or pulled out of the spinal cord.

Failing these plans, next to do is to deliver the posterior arm, it being necessary to insert the whole hand in order to reach it, and it is wiped down over the face—not over the back. Now extraction is always possible unless there is some monstrosity. This will at once be discovered by the hand which has been introduced, and, of course, the treatment will be guided by what is found. Exenteration, cleidotomy, or other cutting operation will usually be advisable under such circumstances.

Since these manipulations take much time, during which the child may die, a few moments should be spared to insert a catheter into the child's trachea and to blow sufficient air into its lungs to prevent asphyxia. Time to effect the disengagement of the shoulders is thus obtained, the operator may work deliberately, and more certainly avoid damage to the child and the mother.

#### LITERATURE

*Davis:* Amer. Jour. Obstet., December, 1910, p. 978.—*Ingraham:* "History of Forceps," Amer. Jour. Obstet., 1911 vol. ii., p. 830.—*Reynolds and Neveu:* Amer. Jour. Obstet., January, 1910.

## CHAPTER LXXII

### CESAREAN SECTION

**CESAREAN** section is the removal of the child from the uterus through an incision made in the abdominal wall. The term may not be applied to the removal of a child from the belly after rupture of the uterus, nor to operations for ectopic pregnancy.

The term probably is derived from the Latin, *partus cesareus*, from *cedere*, to cut. The **m** cesarean section, therefore, is really a redundancy. There is no evidence to show that **ilius** **Cæsar** was thus delivered. **Cesones** (children delivered by section from their dead mothers) **re** known long before **Cæsar's** time, and the operation was not performed on the living. **Cæsar's** **mother** was alive at the time of his wars, as is proved by his letters to her.

Cesarean section on the dead woman has been done for ages, possibly even by the early **gyptians**, and the operation is referred to in the myths and folklore of European races. **Dionysus** **s** cut from the dead **Semele**. The *Lex Regia* of **Numa Pompilius**, 715 B. C., expressly commands **s** removal of the child before the burial of its mother.

Cesarean section on the living is of more recent date, though it is more than possible that it **s** performed by earlier peoples. "**Jotze Dofan**" was the name the ancient Jews applied to **ildren** delivered through the flanks of their mothers. In the heart of Uganda in 1879 **Felkin** **tnessed** a cesarean section performed by a native. The operator—a specialist—washed his **nds** and the operative field with banana wine (antiseptis!), the patient being drunk with the **me** (anesthesia!). A quick incision opened the uterus. After cutting the cord and removing **e** **placenta** the cervix was dilated from above, the uterus massaged and compressed, the peritoneal **vity** cleansed by raising the woman up, then the abdomen closed by pin and figure-of-8 **tures**, the wound being dressed with a paste of crushed herbs. The temperature remained below **11°** and the wound healed in eleven days. For how many centuries must these savages have been **ing** this operation to have developed so good a technic?

The first generally accepted cesarean section was made by **J. Trautman**, of **Wittenberg**, in **110**, on a case of *hernia uteri gravidi*. About 1500 **J. Nufer**, a swinegelder in Switzerland, had **ccessfully** delivered his own wife after a dozen midwives and several barbers had failed, and in **181** **F. Rousset** had published 15 cases, which probably were not all extra-uterine pregnancies, **s** has been suggested. **Rousset's** monograph established the operation, and in spite of its own **ightful** mortality and the resultant opposition by many of Europe's best accoucheurs, it very **owly** became an acceptable resource in those forlorn cases where the parturient almost to a **ertainty** would have died without it. The Catholic Church had much to do with the habilitation **f** the operation, since it enabled the rite of baptism to be given to the child. **Sigault's** symphysiotomy for a few years only was a competitor of cesarean section.

**Kayser** (**Copenhagen**, 1844) found a mortality of 62 per cent. for the previous eighty years, **ut** **Tarnier** said that up to his time there had not been a successful case in **Paris** during the nine-**teenth** century, and **Spaeth** said the same thing of **Vienna** in 1877. **Harris** collected 80 cases in the **United States**, with a mortality of 52 per cent. The causes of death were hemorrhage and infection. **n** cesarean sections sutures were not put in the uterine wound because the ends could not be left **ng** for the subsequent removal, as was the custom in olden days. As a result the women often died **f** hemorrhage into the peritoneal cavity. For the same reason lochia escaped into the belly and usually set up peritonitis. Further, aseptic technic was unknown, and all laparotomies were fearfully **angerous**. In 1769 **Lebas** put three stitches in the uterine wound and left the ends long, by which **ey** were subsequently removed, with success, but a true efficient uterine suture was not made until **änger** recommended it in 1882. In 1877 **Porro**, of **Pavia**, to avoid the dangers of hemorrhage and **f** infection from the leaking of the lochia, advised the supravaginal amputation of the uterus after **ie** child was delivered, and for a short time this operation bid fair to replace the old conservative **sarean** section. **Sänger's** operation in 1882 showed such good results that **Porro's** was soon **legated** to its proper place—as an operation where there is some special indication for sacrificing the uterus. The essentials of **Sänger's** operation are: median abdominal incision; median **erine** incision, with or without eventration of the uterus; use of rubber ligature around cervix **s** stop hemorrhage; resection of a strip of uterine muscle under the peritoneum; interrupted **ver-wire** seromuscular sutures, avoiding the decidua—8 or 10; interrupted fine silk seroserous **embert**) suture, 20 to 25; extreme antiseptis.

Previous to **Sänger** the abdominal incision had been made in all possible locations, the uterus **ened** in many different places and ways, drainage of the uterus, of the abdominal cavity, above **id** below, and many other devices had been practised. The object was to avoid hemorrhage, **epage** of lochia, adhesions of the uterus to the abdominal wall, to the omentum, with the danger **f** rupture of the scar in subsequent pregnancies. With the general improvement of our aseptic **chnic** the results of **Sänger's** operation got better, and it was found possible to dispense with



many things be considered necessary. Many varieties of suture have been recommended—through-and-through interrupted or continuous, buried muscular, seromuscular, decidual, three layers, four layers, silkworm-gut, wire, silk, catgut, etc. We cannot describe them all, but will give the technic as practiced today.

**Indications for Conservative Cesarean Section.**—These are absolute and relative. The absolute indication for cesarean section exists when the parturient canal is narrowed so much that the child, even reduced by mutilating operations, cannot be gotten through with safety to the mother. Contracted pelvis with a conjugata vera of 6 or  $6\frac{1}{2}$  cm. or an immense child will give the absolute indication, but the narrowing of the passage may be produced by exostoses, irremovable tumors, stenosis of the cervix, vagina, and neoplasms of the uterus and adnexa, prolapse before the child. If these conditions are discovered early in pregnancy, many may be removed before labor. In labor there is no choice.

The relative indication, speaking broadly, will exist when the accoucheur decides that the abdominal delivery offers better chances for both mother and child than delivery from below. It is largely subjective.

In contracted pelvis, excepting the absolutely contracted, cesarean section is considered only with a view to saving the life of the child, because we can, by means of embryotomy, very safely deliver from below. The field claimed for cesarean section from the relative indication is in pelvis with a conjugata vera of from  $6\frac{1}{2}$  to 9 cm., depending on the size of the child. This is also the field claimed by pubiotomy, prophylactic version, forceps, and expectancy. This brings us again to the treatment of contracted pelvis. (See pp. 727-733.) When the woman is in prime condition, which means that she is not infected and not exhausted by labor, and when, also, the child is in good condition, my preference is for cesarean section. If the woman has been examined by questionable hands; if she has been in labor many hours; if the bag of waters has been open a long time; if attempts at delivery have been made—the classic cesarean section, while not always positively contraindicated, is a risky operation, and I do not perform it under such circumstances. Pubiotomy, extraperitoneal cesarean section, high forceps, and craniotomy should be considered. If the woman is infected, as shown by fever, fetid liquor amnii, tympania uteri, necrotic areas on the vulva, cesarean section from the relative indication is absolutely forbidden. Fortunately, one may devote all his efforts to save the mother, since under these circumstances the child has nearly always already succumbed.

Placenta prævia as an indication for abdominal delivery has latterly been much discussed, and, as was already said, my opinion is in favor of it when the patient is at or near term, in good condition, the child alive, and the placenta central or large, covering the os. Eclampsia, at or near term, with the os tightly closed, proposed by Halbertsma as an indication, has received few supporters. Vaginal cesarean section is preferable, but if the woman is at term or near it, if the cervix is long and hard, if the parametria are edematous, or if the hemorrhage while operating below is too great—as happened with two of my cases—the abdominal route is better.

Abruptio placentæ is a proper, though rare, indication for cesarean section when the birth-passages are totally unprepared, if the woman is in a maternity or cannot be gotten there in time. Prolapse of the cord, in the absence of contraction of the uterus or other contributing indication, will hardly be admissible as a reason for the abdominal delivery, though one can imagine cases where it would be justifiable.

Nowadays, cesarean section is so safe that it is freely performed, where formerly it would not have been even thought of; indeed, it is being done too often and for insufficient indication. In 126 cases of my own the following were the indications: Contracted pelvis, 86; placenta prævia, 13; eclampsia, 3; stenosis of cervix, 1; vaginofixation of uterus, 1; slightly contracted pelvis, scars in cervix and placenta prævia, 1; vaginal scars with pelvic abscess, 1; healed vesico-ureterovaginal fistula, 1; contracted pelvis and mammoth child, 2; mammoth child, 4; ovarian cyst,

**small pelvis, 1; fibroids and infection, 1; fibroids and contracted pelvis, 4; habitual death of fetus in labor, 2; acute yellow atrophy of liver, 1; eclampsia (postmortem), 1; breech presentation in aged primipara, threatened asphyxia of fetus, 1; previous cesarean, 2.**

Reynolds and Newell in Boston believe that the abdominal delivery is preferable to a hard, or possibly instrumental, labor through the natural passages in cases where the woman is unfit, as regards her nervous constitution and general **makeup**, to stand the strain of labor. While at the first impression this seems **extreme**, it is certain that every accoucheur of experience will recall cases where the **profound prostration and nervous shock** of even spontaneous deliveries have left **permanent traces** in the woman's life. In my opinion the **psychic influence of labor** should be given a prominent place in our deliberations when selecting a mode of delivery.

Should the dictum "once a cesarean always a cesarean" hold? Much disagreement exists on this point, and a decision cannot be reached until we know how **many cesarean uteri rupture** in subsequent labors. Findley, Spalding, *et al.*, find **numerous reports of such fatalities**. Without doubt the uterus after section is **weakened** in the scar, and this is especially marked if the muscle was sewed improperly or if its healing was disturbed by infection, but in the majority of instances it stands **the strain of subsequent labor well**. Since it is impossible here to discuss the **subject fully**, I will state my position: Subsequent cesarean is necessary—(a) when the **reason for the first one still exists**, *e. g.*, contracted pelvis; (b) when infection occurred after the first; (c) when it is known to have been done imperfectly; (d) when **a hernia in the scar or other condition makes it desirable to reopen the abdomen**, *e. g.*, the advisability to tie off the tubes, appendicitis, fibroids.

**Conditions.**—For the absolute indication there are no governing conditions—the child must be removed abdominally whether or not it is alive, and regardless of the condition of the patient. If she is infected, extirpation of the uterus should follow.

For the relative indication to hold, the mother and babe should be in prime condition. It is very important to make sure that the child is not a monstrosity, **as an acephalus**, which is not easy. One may now get an *x-ray* picture of the child. In the presence of kidney, lung, heart, or general diseases the questions of risk of anesthetic, of shock, and of infection must receive careful consideration with a medical consultant. In the presence of infection the relative cesarean section is contraindicated. Gonorrhea comes in this class.

The cervix must be patulous for the escape of the lochia; if there is cicatricial stenosis, the uterus must be removed. It is best to operate when the woman has **had regular labor pains for an hour or more**. Barnes (1876) advised to operate just before labor began, in order to avoid the disadvantages of emergency, a plan also recommended by Bar. The objections to this are: Hemorrhage from the uterus is greater, a few deaths having occurred in former days; the uterus in premature labor does not contract well; the cervix is closed, and drainage is poor; it is **difficult to determine the exact date of term**, and a premature infant or premature twins may be delivered. The advantages of operating before labor has begun are: **Everything can be gotten ready without hurry**, as for ordinary laparotomy, which **means much for the assistants and nurses**; operation by daylight; the accoucheur **can usually have had some rest**; the bag of waters is still intact; the cord or extremities will not have prolapsed; accidents and delays in transportation, etc., are avoided.

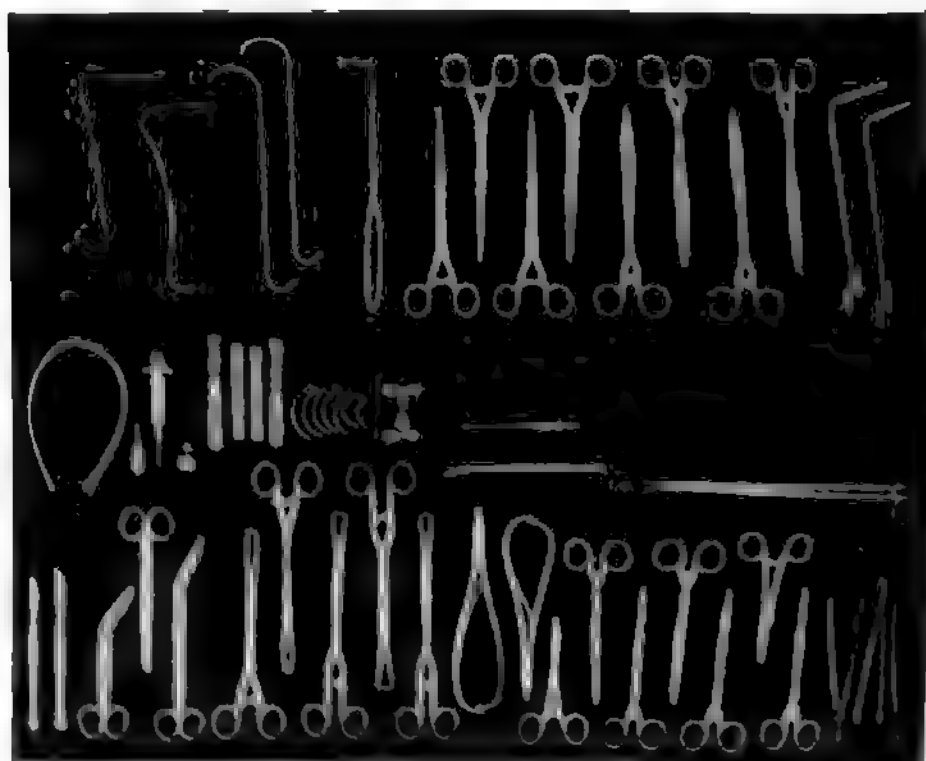
By the prophylactic administration of ergot, the injection of pituitrin, by **packing the uterus with wet hot pads**, brisk kneading, and compression of the **aorta** the hemorrhage is controllable; by dilating the cervix drainage of the uterus may be provided, and by careful study of the cases the proper time for the operation may be determined. I often operate before labor begins. When a Porro is

to be performed, the element of danger from hemorrhage and lochial seepage is eliminated, and, therefore, the operation may be undertaken at any time.

**Technic.** It is important to get the patient into the best possible general health beforehand. Regulated outdoor exercise, care of the bowels, and much sleep are provided. The skin of the belly should be cured of eczematous and other eruptions. As a routine may be recommended the washing of the belly with tincture of green soap. Douches, without special indication, are forbidden, and the patient is impressed with the importance of local cleanliness and the *abstention from intercourse or self-examination*. If possible, she should be in the maternity a week or more in advance of the date set, especially if she has had a previous section. General diseases—for example, nephritis, hemophilia—are treated as thoroughly as we know how. Gentle laxatives are used a few days before, and an enema the day of, the operation.

**The Operation.** Fig. 881 shows the instruments required.

Preparations for reviving the child should never be forgotten. Four assistants are needed—one for the anesthetic, one, specially trained, to resuscitate the child, one to help on the other



inserted into the peritoneal cavity. Now the uterus is brought to the middle line and steadied by the assistant. With another knife a longitudinal incision, 5 inches long, corresponding to the abdominal one, is made half through the thickness of the uterine wall, and with lessening strokes the cavity of the egg is opened; then, cutting between two fingers with scissors, the opening is enlarged both ways to the size of the first uterine cut. Liquor amnii gushes out while the operator searches for one foot, on which he makes the breech extraction, following minutely the classic operation with Smellie-Veit on the after-coming head. The assistant presses the sides of the belly against the retracting uterus to keep liquor amnii and blood out of the peritoneal cavity. Clamping the cord in two places and cutting between requires only an instant, the operator handing the child to an assistant who stands at his elbow bearing a large tray covered with an aseptic blanket. By means of a vulsellum at either end of the uterine incision the uterus is pulled firmly against the abdominal opening, but not out, thus preventing exposure of the bowel and the entry of blood, while, also, the inner edge of the cut is everted for suture, an important detail. The placenta usually falls free into the hollow of the uterus, but the membranes must be pulled off gently and slowly to get them all. After the secundines are out, with a gauze pad the interior of the uterus is wiped perfectly smooth, all shreds of placenta and membranes being removed, and a clean pad is stuffed into the gaping cavity, which rapidly closes as the organ retracts and contracts. This is aided by gentle kneading and firm compression. The most important part of the operation is

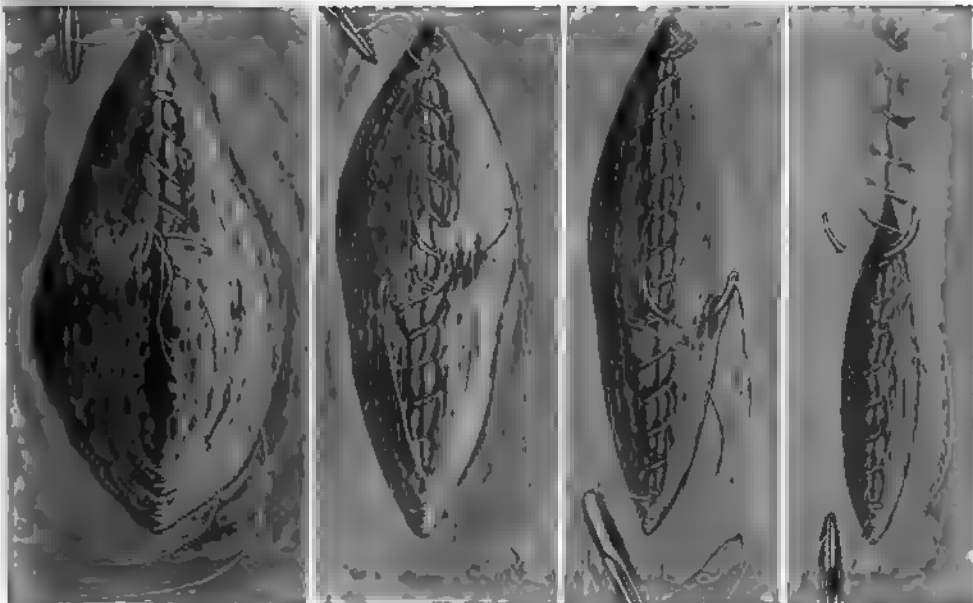


FIG. 882.—UTERINE SUTURE, FIRST ROW.  
Does not take in mucosa.

FIG. 883.—SECOND ROW.  
Buried. Returns and ties with first knot.

FIG. 884.—THIRD ROW.  
Buried.

FIG. 885.—FOURTH ROW ONE PERITONEAL SURFACE.  
Taken in part of muscle, ties with the second part which is buried.

the uterine suture. Beginning at the upper end of the incision a row of sutures is inserted just beneath the endometrium, taking care this is not turned into the wound; turning back from the other end of the incision a second row is placed, taking in substantial portions of the muscle. The two ends of the catgut are tied, leaving one knot. Beginning at the lower end of the incision a third row of sutures is passed and, reversing at the upper end, comes down on the peritoneal surface of the uterus to be tied at the lower end in the second knot. For extra safety I usually put in a few interrupted superficial sutures, indeed, I often make five complete rows, in order to keep broad surfaces in close apposition until they have united. No. 2 twenty-day catgut is used. Care should be used to get accurate coaptation in the angles and too much constriction of the tissues avoided for fear of necrosis when the uterus contracts and tightens the sutures. The knots must be firmly tied. It is usually possible to determine three layers of muscle—one, the thickest, internal, next to the decidua, and darker in color, probably because the fibers are cut across; another, a little thinner—the middle coat; and a third, very thin, to which is attached the peritoneum. Time taken to apply an accurate uterine suture is well spent. Too rapid and spectacular operating is responsible for many bad results.

Now the uterus is replaced, the peritoneal toilet is made, the small intestines pulled up out of the pelvis, the omentum drawn down behind the uterus, and the abdominal wall closed with three or four layers of sutures. I usually use No. 2 chromicized catgut, double thread, for the fascia, and continuous silk for the skin.

While cesarean section is a simple operation, to attain success requires a subtle technic and close attention to every detail.

**Complications.**—Adhesions are seldom met in primary operations, but, nevertheless not to cut too boldly into the belly. After previous sections adhesions are the most common are of the omentum, or of the uterus to the abdominal wall, or the omentum to the uterus. Rarely a coil of gut is attached to the uterus under the line of the incision, and rarely the cecum, appendix, or sigmoid may be adherent behind and tear when the uterus is incised. Where adhesions are known or suspected, the belly should be opened at a spot where there is no adhesion, and two fingers inserted to determine their location and extent. A clear space on the abdominal wall should be quickly made, and the child and placenta delivered, after which the adhesions should be removed according to general surgical principles. It is best not to deliver the uterus if there are adhesions. Adherent gut must be very tenderly handled. If the omentum can be tied off from the abdominal wall without denuding it much, this should be done—large rough areas of omentum invite new adhesions. If the uterus is intimately bound to the abdominal wall, it is best not to attempt its separation unless extirpation of the organ is to be performed. In the latter instance a segment of the uterus, together with the abdominal wall, should be removed. In a second cesarean section the uterine incision should be parallel to and above the scar of the first one, and weak portions of the muscle excised.

If a hernia of the old scar is present, the sac is to be excised and the edges of the muscle brought together anew.

**The Placenta.**—In 42 of 57 cases where the site of the placenta was noted the placenta was situated on the anterior wall and had to be cut out to gain access to the infant. It is not always possible to be sure of the location of the placenta beforehand. The course of the round ligaments (which run anteriorly) and the prominence of the veins in the violaceous surface of the uterus give some indication of it. If the first cut into the muscle causes profuse hemorrhage, anterior incision is suspected, but the operation does not differ from the usual one, except that the movement is hastened. I usually cut right through the placenta.

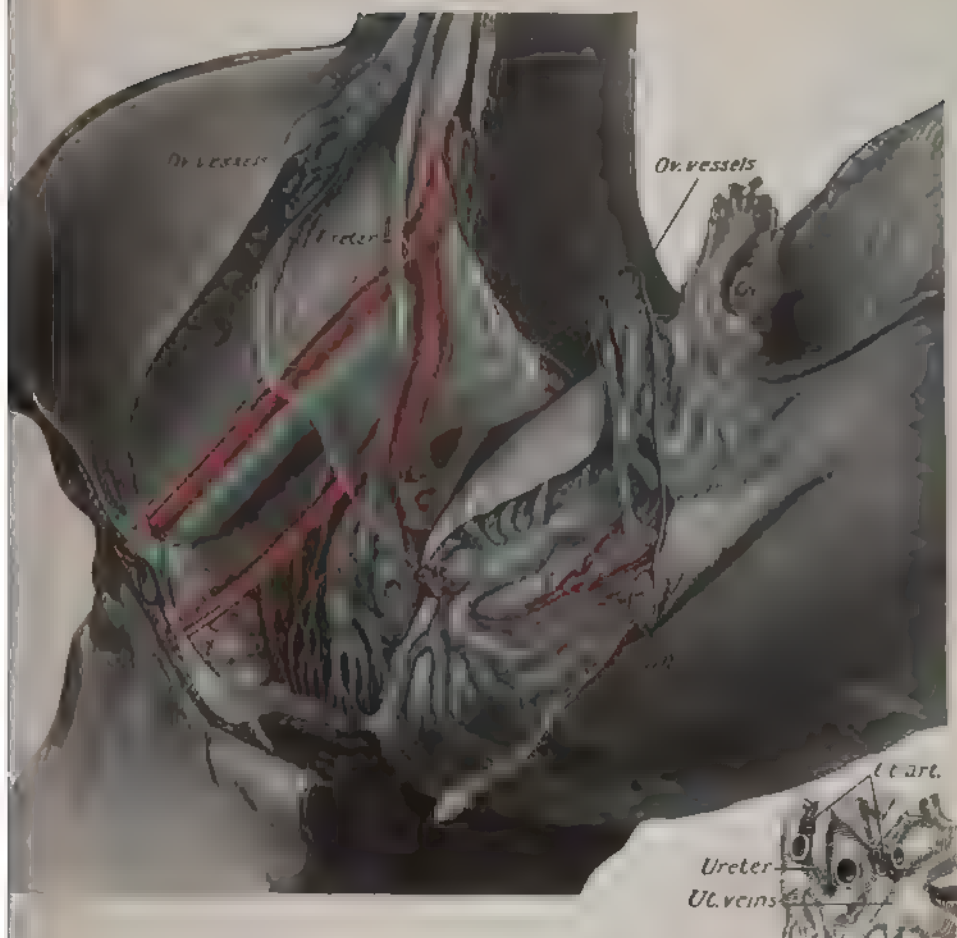
**Hemorrhage.**—Where the placenta is cut or torn, bleeding is usually profuse, both before and afterward. A prophylactic hypodermic injection of 20 minims of aseptic solution is given as a routine before the anesthetic is started; as soon as the child is delivered the placenta is to be removed, taking care to get all the membranes; then the uterus is kneaded briskly between the hands while it is covered with pads wrung out of very hot salt solution. The inner surface is washed with a pad wrung out of hot salt solution, and the uterus held tightly in the grasp of the operator. The quickest way to stop the bleeding is by closing the uterine wound, which should be done with the utmost despatch. Then the massage is repeated. If this does not suffice, four or five minims of pituitrin are injected directly into the muscle in two or three places, making about two inches apart. While these maneuvers are being carried out, an assistant compresses the navel. In Fig. 717. If these measures do not quickly cause uterine contraction and control the bleeding, extirpation of the uterus must be considered. The operator must not forget that blood may escape per vaginam also and in large quantities. If it is desirable to preserve the uterus and the hemorrhage persists, uterine tamponade may be resorted to. Since the wound has been closed, packing is inserted from below in the usual manner. On three occasions I have used tamponade. Recovery.

**Infection.**—If the case is known to be infected, the conservative cesarean section is indicated, and if delivery must be made abdominally, either the Porro operation or extirpation must be practised. In cases of gonorrhea conservative section is very dangerous. Leopold emphasizes, and it is best to consider these, too, infected. There is no need to determine beforehand that the parturient canal is aseptic. Fever, fetid discharge, tympany, and unhealthy wounds at the introitus are evidences of infection of the uterus—at least a danger-signal. In border-line cases the technic must be modified (See Extraperitoneal Section.) If, during an ordinary cesarean section, a septic focus is unexpectedly exposed, for example, an infected dermoid, the intestine, an appendiceal abscess, it is best to resect the uterus and provide free pelvic drainage.

**Uterine Drainage.**—While rubbing the interior of the uterus smooth, it is a good plan to pass the finger down into the cervix, but not through it into the vagina, to see if it is patent. Examination beforehand has shown that the os is open. If the cervix is closed by scars, a crow's quill cannot pass, the uterus is to be amputated. A normal cervix will open spontaneously under the influence of the after-pains. If the accoucheur fears that there is not enough contraction, he may pass gauze or a tube through the cervix into the vagina. It is highly important to catch the gauze in the uterine stitches. One fatality from this cause is on record.

**After-treatment.**—This does not differ from that after the usual laparotomy. 10 minims of ergot four times a day for a week. Cathartics are usually not administered until the eighth day, and then not unless required, the bowels being unloaded by enemata and molasses,  $\frac{1}{2}$  pint of each, make a very efficient clyster, which may be repeated. A camomile tea produces a free evacuation of feces and flatus. The baby is put to the breast at the end of twelve to twenty-four hours.

Of the various postoperative complications, peritonitis, ileus, and uterine abscess are the most common. If a beginning peritonitis is diagnosed, the patient must be constantly watched, hourly observations must be made, and if the pulse grows steadily faster, the temperature rises higher, the abdominal rigidity increasing, with leukocytosis—in short, if the observer is convinced—and the time required to know whether the infection is progressing, the belly is to be reopened and drained. In cases of acute dilatation of the stomach occur, it seems to me, oftener after cesarean section than after other celiotomies. For ileus the usual methods of treatment are practised. One that is reliable after cesarean section is to hang the woman, inverted, from the shoulders of an assistant with the finger in the rectum push the heavy uterus up out of the pelvis, and give a big flushing of milk and molasses, with the patient depending. In one case an electric vibrator to the distended bowel seemed to help. Eserin had failed. Pituitrin is not recommended.



386.—TOPOGRAPHY OF UTERINE VESSELS. PREGNANCY OF SEVEN MONTHS. L. R., LIGAMENTUM ROTUNDUM. Adapted from Couvelaire.

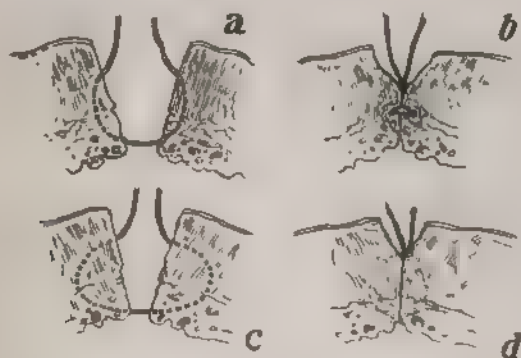


FIG. 387. WRONG WAY (a and b), AND RIGHT WAY (c and d), TO PASS NEEDLE IN UTERINE SUTURE.

the grinding contraction of the uterus may tear the sutures apart. These measures have been successful in my practice in the treatment of gastric dilatation; having the woman lie on the left side, the foot of the bed being elevated 18 to 24 inches; gastric lavage, repeated every four hours; massage of the stomach; rectal feeding. Both ileus and dilatation may be caused by tight abdominal binder, a point that I would emphasize strongly. In all probability a peritoneal infection is responsible for most of the cases, and bursting of the fascial suture for others. Uterine abscess is to be suspected if there is a mild fever, with signs of local peritonitis and partial ileus. Usually the abscess breaks on the surface, the wound opening. With good drainage the patient quickly recovers, but the uterus is permanently ventrofixated and the scar may give rise to a subsequent pregnancy.

*Prognosis.*—By rigid examination of the cases and the exclusion of all that present a suspicion of infection, the mortality of the conservative cesarean delivery can be reduced to nothing. Series of 40 to 100 cases without death have been reported. Houth, in 1916, with great labor the statistics of Great Britain, comprising 1282 cases, and these may be taken



FIG. 888. PORRO CESAREAN SECTION.

Both broad ligaments are clamped, taking in the round ligaments because of the variation in position.

a type for all civilized countries. He shows that there has been a steady decrease in mortality until now, in favorable cases, it is from 2 to 4 per cent. In cases where labor had begun, or even attempts made with the forceps, the death-rate was 34 per cent, and over 70 per cent if had been in progress some time with the membranes ruptured he found 10.8 per cent, the best showing being made in those cases where labor had just begun, the bag of waters intact—2.2 per cent. It is generally admitted that the dangers of cesarean section are: hemorrhage every hour the woman labors, especially if the membranes are opened the vaginal bacteria invade the uterine cavity. The exhaustion of active labor diminishes the woman's resistance to infection. Routh gives the general mortality of cesarean section for all indications as 14 per cent, and if one takes only the last five years, it is 8.1 per cent. Nowell makes the statement that in several of the towns near Boston the recovery of a patient from cesarean section is a rarity. I know of 4 deaths in Chicago in the last year. Williams believes the mortality is about 10 per cent.

The operation as generally performed has a high morbidity. Fever is present in 90 per cent of the cases, while post-operative bronchitis and pneumonia, uterine abscess, gastric dilatation of some degree, infected cutgut with hernia, may too often complicate

every. Of my 124 cases, 3 women died, one from peritonitis and one had nephritis, the operation being done for eclampsia; one from acute yellow atrophy of the liver, for which the operation was advised. Taken all in all, it is not an operation to be lightly advised. The mortality of the children would be zero if the infant was well at the start. Two babies of the 124 died, one from asphyxia—*ipsius artis*—one from a cause indeterminable by autopsy.

Repeated cesarean sections have been done in large numbers, Nancrede in 1875 having done a sixth operation on the same woman. In such cases the uterus is so broadly adherent to the abdominal wall that it may be opened without entering the general peritoneal cavity. I do not recommend to try this, because intestines may be adherent to the scar. Twenty-eight of my cases were

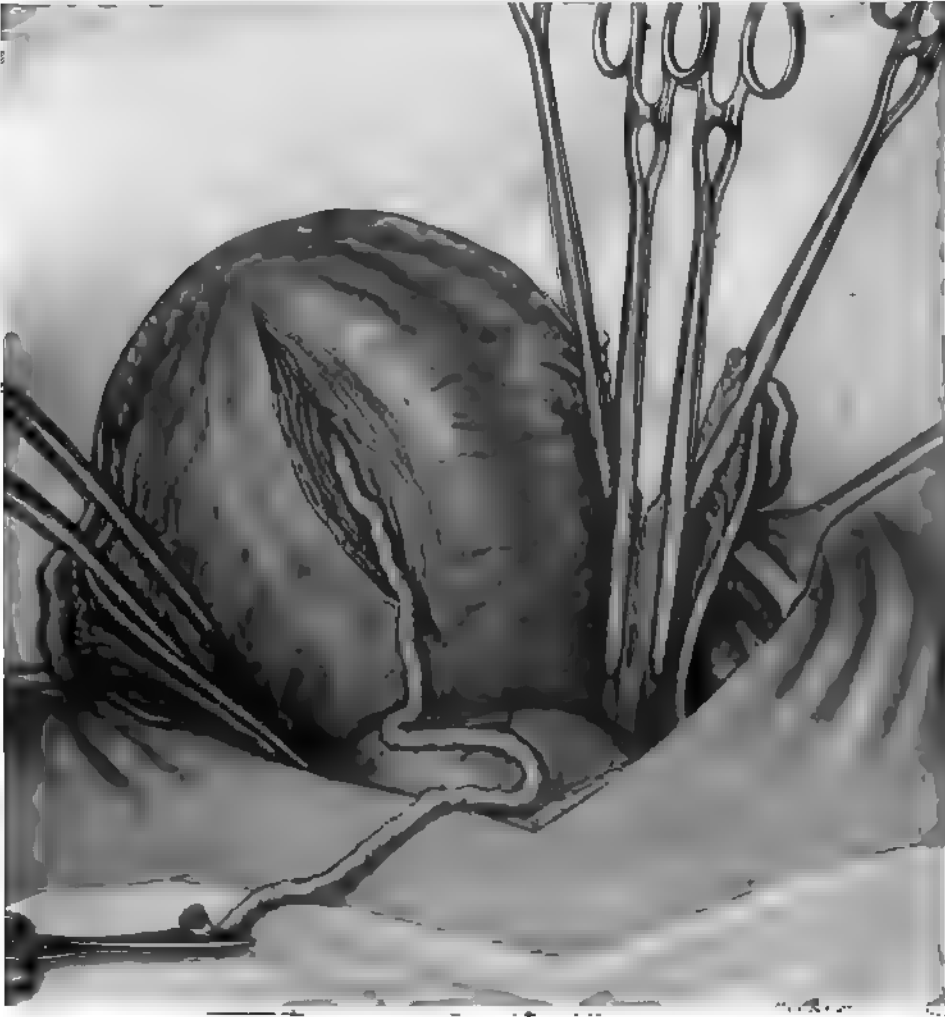


FIG. 889.—PORRO CESAREAN SECTION.

After cutting one side, two clamps are placed, reaching to about the level of the uterine artery.

second operations. Polak, in 1909, collected 150 cases of repeated section, which showed a mortality of less than 5 per cent., which is as good as, if not better than, the primary cesareans. In the earlier times, before the uterus was sutured, rupture of the scar in subsequent pregnancies was not uncommon, but lately, as was shown by Brodhead, the accident has become quite rare, and this is because the uterus is sewed up better and because in many cases the patient is sterilized. It is important, however, to have the woman in a maternity in the last few weeks of her subsequent pregnancies, and also to operate a few days before the expected onset of labor pains. (See Davis.)

**Sterilization with Section.**—Should the woman be sterilized to prevent future pregnancies? Authorities differ between wide extremes, and in deciding one must consider the dangers of subsequent pregnancies and labors and the necessity for consecutive cesarean sections.

If the woman has tuberculosis, chronic nephritis, osteomalacia, or any disease which in itself is a contraindication to pregnancy, she should be sterilized. Any one who admits the propriety of inducing abortion for such conditions must admit the above postulate. Contracted pelvis is not allowed in this category.



The danger of rupture of the uterine cicatrix in subsequent labor is no indication. It can be avoided this by properly sewing the uterus, by placing the patient in a good maternity position weeks before labor, and operating before pains set in.

If the first section is done for eclampsia, placenta prævia, abruptio placentæ, prolapsed cord, faulty mechanism of labor, pelvic tumors, in the absence of other indications the uterus should not be sterilized. If the woman has a large family, the question is discussable, but if it is only one child, and that one weak or deformed, it is better not to sterilize her.

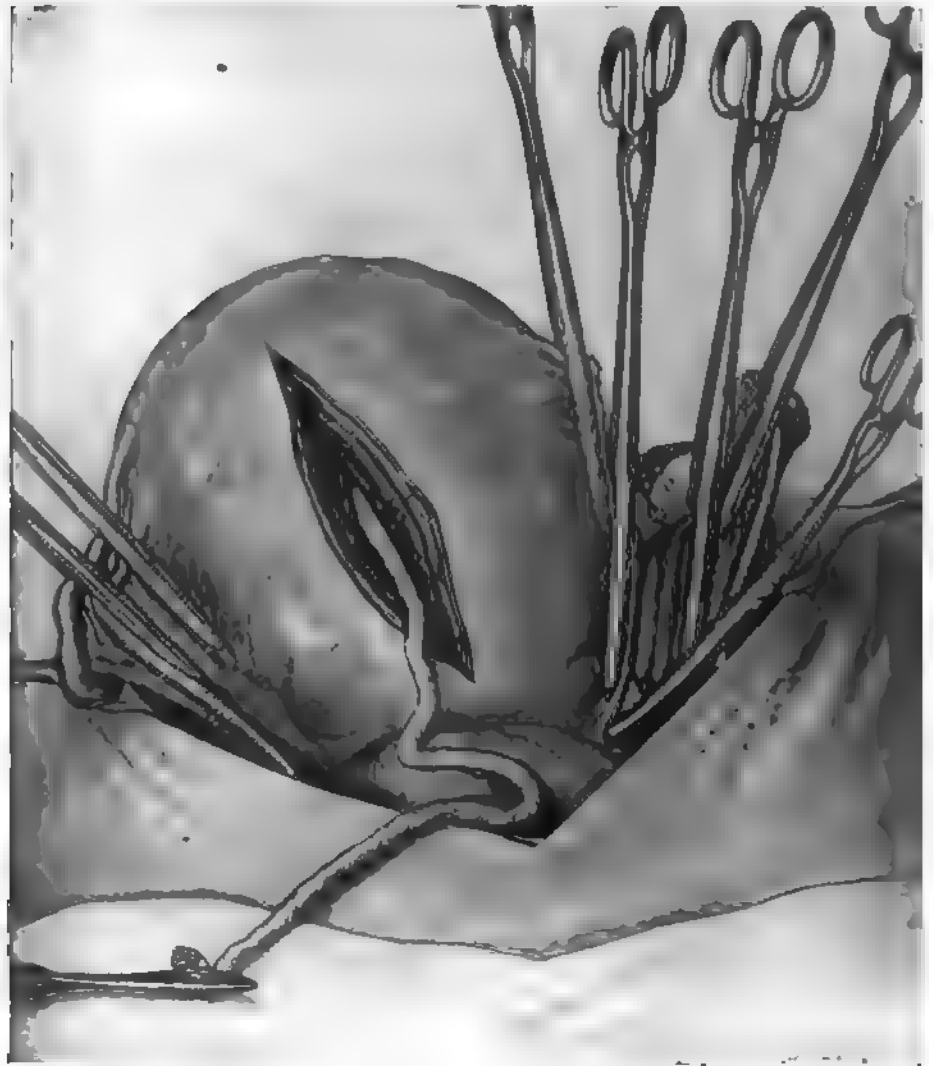


FIG. 890.—PORRO CESAREAN SECTION.

A clamp is put on the uterine artery, taking care that it grasps the tissue at the side of the uterus, and not the pelvis, to avoid the ureter.

If the cesarean operation is done for contracted pelvis, I earnestly dissuade the patient from such a procedure at the first section, pointing out the fact of the safety of subsequent labor, the possibility of the death of the only child, and the unhappiness of a one-child family. At a second cesarean I willingly sterilize, if requested, although lately, since the mortality has been so much reduced, I often suggest a third operation. At operation one may reverse the sterilization if the child is not of the desired sex, or if it is asphyxiated and of doubtful recovery.

For many years the ethics of sterilization have been debated. Green presented an excellent discussion of it at the 1903 meeting of the American Gynecologic Association, taking an entirely negative position. Most American, English, and Continental authors concede the right of decision to the mother and her family, after they have been given a fair presentation of all the facts. I take a position which I also take. By following the Golden Rule I have had no difficulty in arriving at a satisfactory course in these matters.

**Methods.**—Ligation, simple section or exsection of a portion of the tube, as recommended by Blundell in 1819, have proved insufficient, pregnancy having occurred in spite of them. In oostomalacia ovariectomy is done. Ablation of the tubes is safe, as is also removal of wedge-shaped pieces of the uterine horn containing the tubes. The method I use is exsection of an inch of the tube near the uterus and burying both ends securely under the peritoneum of the broad ligament. The peritoneum may be slit open, an inch of the tube itself removed, the gap being filled up by the connective tissue. It would be possible, should pregnancy be later desired, to reopen the belly by anterior colpotomy and anastomose the cut ends again. Extirpation of the uterus as a means of simple sterilization is hardly to be recommended, certainly not in young women. The desire to have all the functions of a woman is strong, and seldom do the patients not regret the loss of the menses. I agree with Williams that the operation can be done in the same time as removal of the tubes, and that the postoperative recovery is prompter and more satisfactory than in the con-

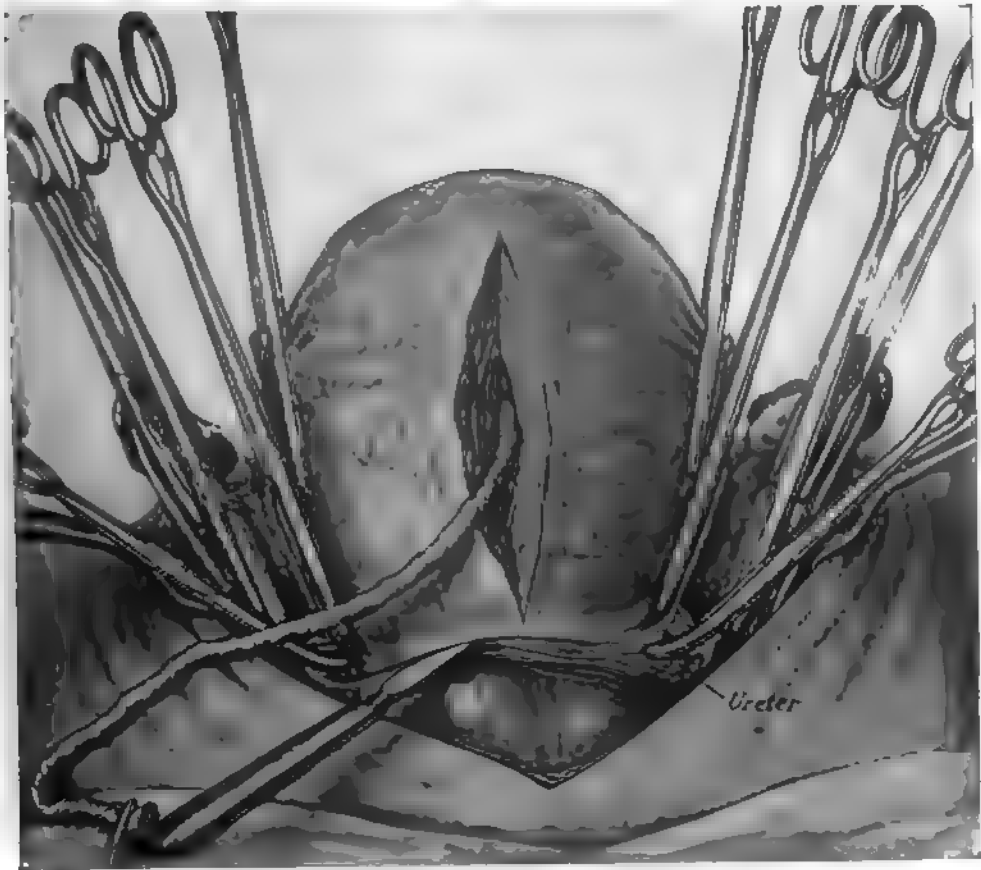


FIG. 891.—PORRO CESAREAN SECTION.

After the process has been repeated on the right side, the peritoneum is severed one-half inch above its reflection on to the bladder. The ureter does not come into view, and lies a short distance farther away from the forceps than is indicated in the drawing. The location of the uterine artery may be determined by touch.

servative cesarean section, but the technical difficulties are greater with amputation of the uterus, and premature menopause is not rare, even if one or both ovaries are preserved.

**The Porro Cesarean Section.**—In 1876 Porro, of Pavia, to avoid the dangers of hemorrhage and of infection from the large uterus, which was poorly sewn up, advised the amputation of the body of the uterus and the adnexa above an elastic ligature placed about the cervix, and the anchoring of the stump in the lower angle of the abdominal wound—an operation similar to supravaginal hysterectomy for fibroid, with extraperitoneal treatment of the stump. The operation had been suggested by Blundell in 1830. Later, when Schröder dropped the sutured hysterectomy stump back into the pelvis, Isaac E. Taylor did the same for the stump after Porro's operation. Porro's radical operation did reduce the mortality of cesarean

section, and gained some vogue, but was soon replaced by the improved conservative operation of Sänger. This was called "conservative" because the uterus was not sacrificed.

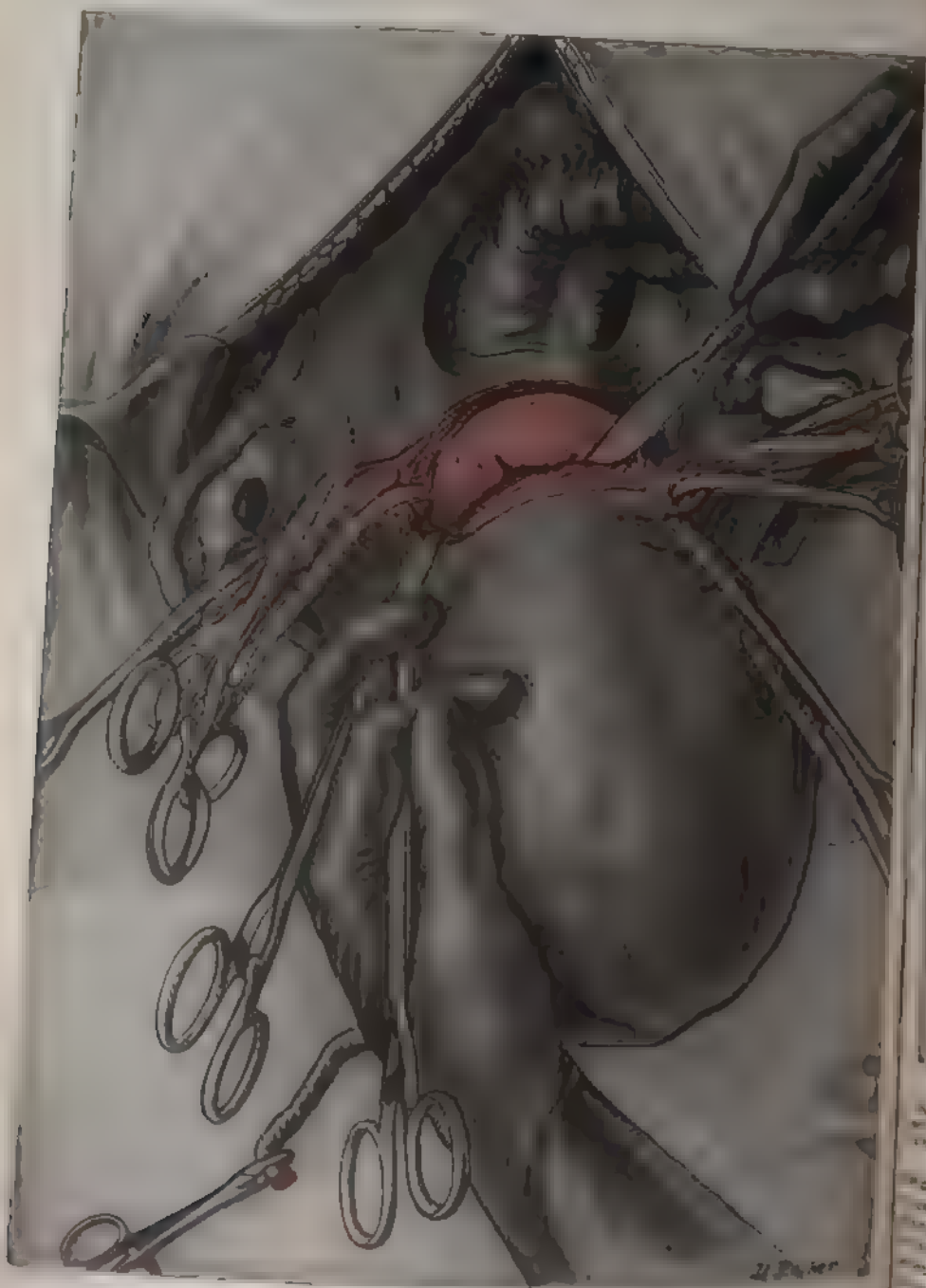


FIG. 392.—PORRO CESAAREAN SECTION.

The large uterus now hangs only at the cervix. It is pulled sharply over the pubis and cut off over half an inch above the cervicovaginal junction, beginning from behind. When cutting the anterior cervical wall, the retention of the blood to the bladder must be watched. There is usually little hemorrhage.

*Indications.*—It may be necessary to remove the uterus when myomata are present, especially if large or if they block the pelvis. Myomectomy may be performed in favorable cases if the woman desires more children. I did it four times



FIG. 896.—KROHN'S CERVICAL CESAREAN SECTION.

Trendelenburg position, 30°. Bladder empty. Median incision from pubis to about 2 inches below navel (Fig. 896). Watch for bladder at lower end when opening belly. One inch above vesical attachment to uterus incise peritoneum. With scissors, and pushing with gauze, reflect bladder off its true wall and downward. Usually no bleeding.

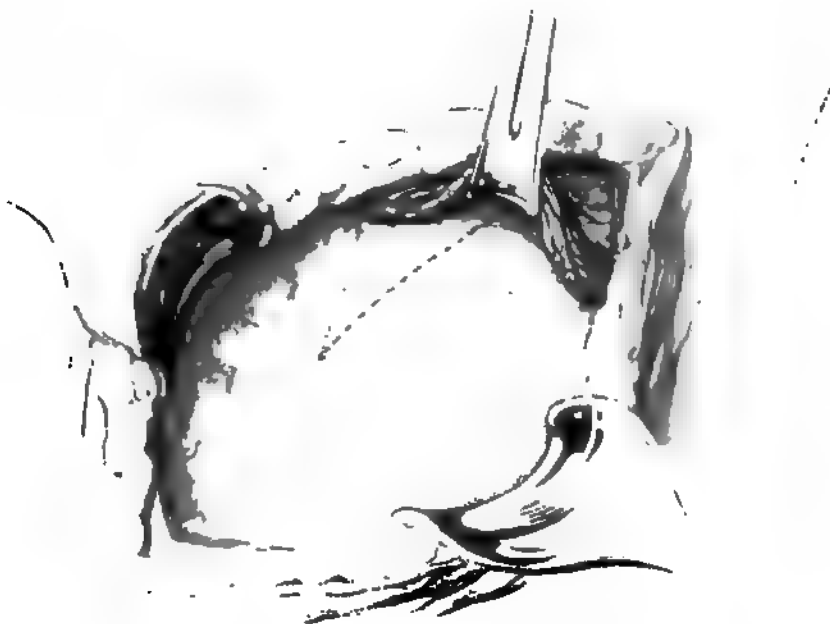


FIG. 897.—KROHN'S CERVICAL CESAREAN SECTION.—FIFTH PERIOD.

Bladder may be pulled a little higher up with the finger and pushed down by the hand. If necessary it may be prolonged upward a little. If possible, at this point introduce the peritoneum to avoid sealing around peritoneal cavity.

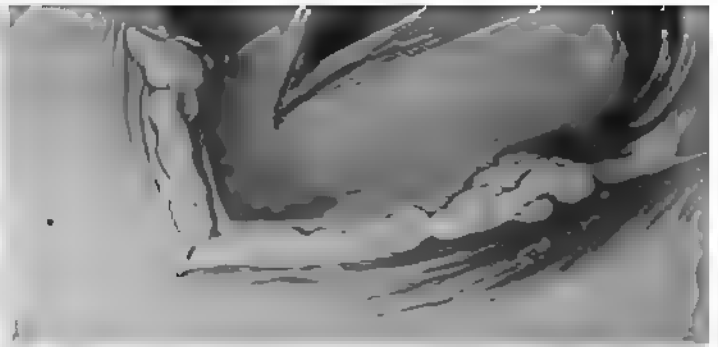


FIG. 508. KRÖNIG'S CERVICAL CESAREAN SECTION. READY FOR DELIVERY.  
Retractors removed, assistant holds wound open with fingers.



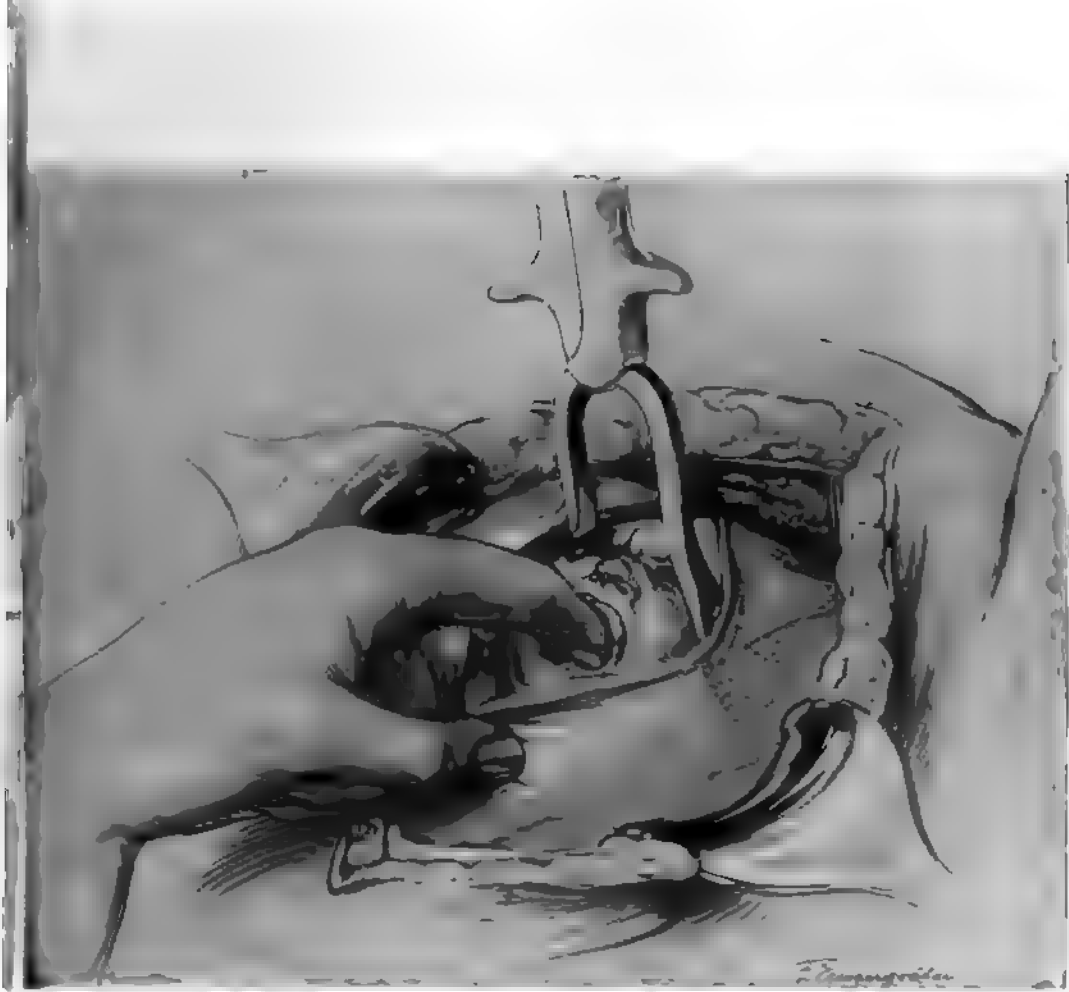


FIG. 900.—KROHN'S CERVICAL CESAREAN SECTION. FORCEPS APPLIED.

Assistant removes finger. Front of forceps points to pubis. Slow delivery to prevent tear extending into bladder, or even ureter. Placenta delivered by Cr   expression or manually. Pituitrin into uterus. Ergot hypodermically. If needed (rare), pack uterus.

leaving the cervical canal open for drainage. Now the peritoneum is sewed together after turning the ligated stumps in underneath it and uniting them to the cervical stump with a few sutures.

Michaëlis, in 1809, recommended the removal of the whole uterus, and Bischoff, in 1880, first practised it—a case of cancer. The operation is much more formidable than the amputation of the fundus. The hemorrhage from the cut vagina and bases of the broad ligaments is less easily controlled.

Cesarean section, with amputation of the uterus in clean cases, and with an expert operator, has the same mortality as the conservative operation, and the morbidity is decidedly less. In the 10 cases of my own recovery was prompter, less painful, and less complicated than after the ordinary cesarean operation. The reason for this is the elimination of the large, involuting, really necro-



FIG. 903.—LATEXTRA-PERITONEAL CESAREAN SECTION.

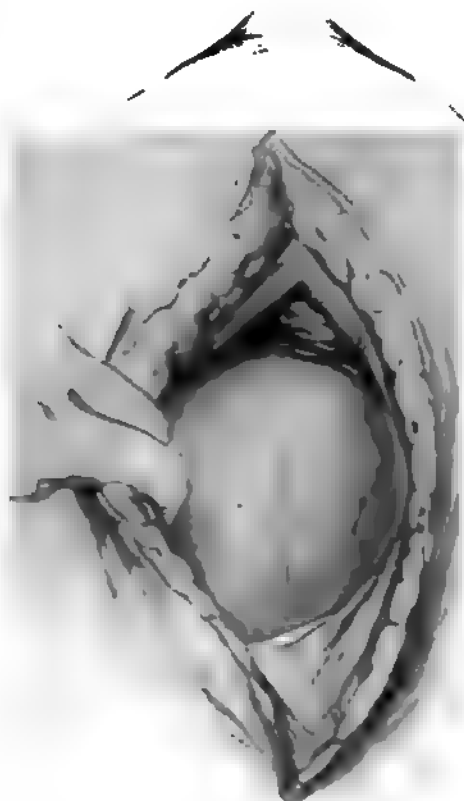
Incision beginning at the pubis to about 2 inches from navel, a finger's breadth left of the median line, down to the peritoneum. Great care not to puncture the latter. Trendelenburg position. Bladder filled with 150 c.c. sterile water, the catheter, clamped, remaining in place. Bladder appears at top of wound, after thorough orientation water let out, catheter left in place. Space of Retzius exposed.

ing uterus, the clearing-out of the pelvis (less absorption), and the covering in of all raw surfaces by peritoneum. In septic cases the mortality is still high—probably near 20 per cent. It is a question if total hysterectomy would improve the results. If, during cesarean section in septic cases, the abdomen could be closed tightly around the unopened uterus and the latter emptied and amputated without soiling the peritoneal cavity, probably many cases of peritonitis could be prevented. With a studied technic such a result is not unattainable.

**Extraperitoneal Cesarean Section.**—In the olden time, when the dangers of opening the belly were almost prohibitive, the accoucheur sought to avoid the necessity of destroying the living child by delivering it from above the pelvis, but

without opening the peritoneum. Joerg suggested it in 1809. Ritgen did it in 1812 and Physick, of Philadelphia, in 1824, recommended it to Dewees. In 1825 Gaillard Thomas revived the operation, named by Baudelocque, in 1823, *elytrotomy*. It consisted of making an incision above and parallel to Pö ligament, blunt dissection under the peritoneum to the cervix and vagina, followed by a flank delivery.

Surgical infection wrought the abandonment of this operation, and it was forgotten. Soon antiseptics and Sanger's technic rendered the classic cesarean



6



mortality of 1 to 2 per cent. and higher in just those cases where one would like to adopt this method of delivery.

It is not surprising, therefore, when Frank, in 1906, revived the older extraperitoneal operation, that his recommendation was eagerly taken up. About thirty different methods have been published, for a review of which the reader is referred to Nicholson and Küstner. All the modifications fall into two classes, the transperitoneal and the true extraperitoneal. In all the incision is made in the most accessible portion of the uterus. In the transperitoneal the parietal

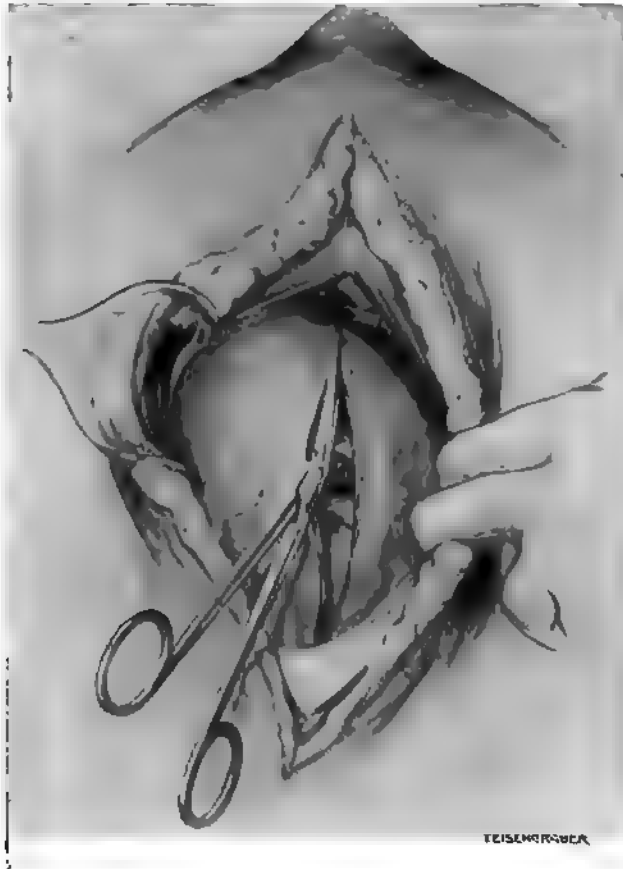


FIG. 905.—LATEAL EXTRAPERITONEAL CESAREAN SECTION.

Guided by the fingers, the thin lower uterine segment is incised. Avoid sharp retractors and too violent lateral pulling.

peritoneum may be sewed to the uterine peritoneum, and in the almond-shaped incision thus provided the uterus is opened and the child delivered. In the extraperitoneal method, the lower uterine segment is bared by pushing the bladder to one side and the vesico-uterine fold upward, thus providing room for the delivery of the infant without opening the peritoneal cavity. All the operations depend upon the fact that during labor the uterus draws upward away from the bladder, and the peritoneum of the vesico-uterine region is loosened from its bed, thus enabling one to expose the distended lower uterine segment. We have learned that this condition varies in different women and with the presentation, a point of great technical importance.

Of all transperitoneal methods the author prefers that of Krönig, shown Figs. 896-902. By following the descriptive legends the reader may learn steps of the operation, thus repetition here is unnecessary. (Hirst, Gellhorn, P. 113.)

It will be noted that the differences from the classic operation are: 1. incision is made in the lower uterine segment; 2. the uterine and parietal peritoneum may be, if desired, temporarily united during the delivery of the child; 3. placental time permitting, to a great degree, the soiling of the peritoneal cavity with blood is minimized; 4. the intestine and omentum usually do not protrude; 5. the uterine suture is more quickly applied; 6. a tiny row of post-operative scars is all that is left, thus reducing to a minimum the danger to a minimum.



The following are the steps of the operation: 1. The patient is placed in the supine position, and the lower abdomen is shaved and disinfected. 2. A horizontal incision is made in the lower uterine segment, about 4-5 cm. long. 3. The parietal peritoneum is reflected upwards, and the uterus is incised. 4. The fetus is delivered, and the placenta is removed. 5. The uterine and parietal peritoneum are temporarily united with sutures. 6. The intestines and omentum are pushed back into the abdominal cavity. 7. The uterine incision is closed with a strong suture. 8. The abdominal wall is closed with a few sutures, leaving a small row of scars. 9. The patient is placed in a comfortable position, and the wound is dressed.

Statistics collected by Stoeckel in 1916 showed in 194 cases only 3 maternal deaths, which is marvelous when one considers that 50 per cent. of these cases were either frankly infected or suspicious.

Of true extraperitoneal operations, that devised by Latzko is the best, and is illustrated here, Figs. 903-907, to which the reader is referred.

Contrary to the transperitoneal method, the true extraperitoneal is not an easy operation, since the pushing of the bladder off the uterus and raising the peritoneum from its attachments are sometimes very difficult. The longer the pains have acted, the more the uterus has pulled off the



FIG. 907.

FIG. 907.—LATZKO EXTRAPERITONEAL CESAREAN SECTION.

Trendelenburg again. Uterine sutures. I always put in two rows. Now draw the peritoneum down, bring the bladder into position. Leave a gauze drain in the lowest corner of wound. Abdominal suture.

bladder, and the easier becomes the separation. It is just the cases of prolonged labor where the operation is most useful. Küstner injured the bladder in 7 per cent. of his cases; ureteral fistula, hemorrhage from the large vessels in the broad ligaments, thrombosis, and a high fetal mortality have been reported. Bumm tore the peritoneum in one-third of his operations. Nevertheless, Küstner and Bumm together report 226 cases, with 4 maternal deaths, less than 2 per cent., again a marvelous showing, because many of Küstner's cases were frankly septic and half were suspicious.

The classic operation is still the one generally practised in America, England, and France, and has therefore been given the most consideration here, but the author now feels that the low, cervical incision will soon be a strong contestant for the honors of preference, and, if the present promise is realized, when the next edition of this work appears, a complete realignment of the indications for the treatment of contracted pelvis in general, and of the methods of abdominal cesarean section in particular, will be necessary.

**Indications.**—Having now three methods of abdominal delivery, modern art demands that the conditions of every case be well studied and the operation appropriate to each one be selected. Lack of space, and the fact that the indications, even on the Continent, are not definitely established, prevent a full discussion of the three methods, wherefore the author will only state his position with regard to each one, and that briefly and with reservations.

In the presence of a general indication for cesarean section the classic operation is done: placenta prævia, fibroids, for a Porro, when the belly is excessively pendulous (one cannot get the cervix well), and in second cesareans when it is known there are many adhesions (*e. g.*, after uterine abscess).

In all other cases Krönig's method is the one of choice. When the woman is positively infected, when she has had many attempts at delivery,—if a Porro is not done, the author holds that craniotomy is the safer operation, in spite of the contrary reports of Küstner, Bunn, and others. In those cases where the infection is apparently mild, or only suspected, the true external peritoneal operation of Latsko is the one to be selected, with suprapubic or vaginal drainage, if both. Gellhorn of St. Louis and Hirst advise the transperitoneal incision, but with preliminary suturing of the parietal to the uterine peritoneum, thus excluding the general peritoneal cavity from the infected field. Only large experience will decide the question of the comparative safety of the two methods, but that the cervical incision is safer than the corporeal in infected cases of this there is no doubt.

**Cesarean Section on the Dying or Dead Woman.**—A fetus will live from five to twenty minutes after the death of its mother. Reported cases of longer period are not authenticated. The length of time of survival depends on the suddenness of the mother's death, the child living longer if she dies of apoplexy, accidental hemorrhage, eclampsia, or very acute affection than if the agony is prolonged. In tuberculosis, heart disease, etc., though in some of the latter cases the vitality of the child is remarkable. Since the mother uses up the child's oxygen, the latter usually dies first. Even before Numa Pompilius, attempts to save the child by cesarean section after the death of its mother were made, but the results were so poor that most men discountenanced the procedure. In recent times the operation has often been done, and the results are more encouraging. If the pregnancy has advanced beyond the twenty-sixth week, no delay is to be allowed after life is positively extinct, but the belly opened at once. It is not even necessary legally to obtain the consent of the husband or the family, though for his own protection the accoucheur should get it if possible. Bacon, of Chicago, in 1911, proved this. Nor should precious minutes be lost trying to hear the heart-tones, because several children have been saved when they were inaudible. (See Remy and Wyder.

The Talmudists and the Catholic law demand that cesarean section be performed on the dying woman to save the child, but this operation, painful to the concerned, has rarely been done. If the woman's death is only a matter of a few hours, this being the opinion of a consultation of physicians, and the child is living and viable, the operation is indicated, but here, legally, it is needful to get the consent of the husband or the next of kin. In practice it may be required to prepare for the operation, and, awaiting the woman's death, to watch the heart-tones, operating before death only if the child shows signs of distress. Naturally, if conditions are right for a quick delivery from below, this is preferable. In Strassburg a woman with mitral disease was operated on, supposedly in agony, but it was only catalepsy, and she recovered.

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## CHAPTER LXXIII

### MUTILATING OPERATIONS ON THE CHILD

UNDER this caption will be considered the operations which reduce the bulk of the child. Lessened in size, it can be easier gotten through the parturient canal. Embryotomy would be a good general term for all the procedures, but it has been given a particular significance.

*Craniotomy* is an operation which consists in opening the fetal head, the evacuation of the brain, and extraction by means of a large bone forceps or a sharp hook.

*Perforation* is the first step in craniotomy, but is sometimes applied to the whole operation.

*Cranioclastis* is the third step in the operation, and is also sometimes applied to the whole operation. The instrument, which is nothing more nor less than a large, strong, especially constructed bone forceps, is called a *cranioclast*.

*Cephalotrypsis* is an operation in which the head is crushed by means of a powerful forceps supplied with a compression screw, no perforation of the head being made. The instrument is called a *cephalotryptor*, and was invented by Baude-locque, the nephew. It is an obsolete operation.

*Decapitation* means what it says,—amputation of the head,—and is accomplished either by means of a blunt hook or a sickle-knife, the *écraseur*, or scissors.

*Embryotomy* is applied to decapitation, to the section of the fetal trunk, or to the opening of the body cavities.

*Exenteration* means disemboweling the fetus to diminish the size of the trunk. It is the same as *evisceration*.

*Brachiotomy* means section of an arm.

*Cleidotomy* is an operation done by Ferondi in 1877 and introduced by Herbert Spencer in 1895. It consists of section of the clavicles, and is used when the shoulders are too broad to pass, the head being delivered and the child dead.

*Spondylotomy* is section of the spinal column.

Before forceps and version were known, removal of the child piecemeal was the only means the ancients had of accomplishing delivery in cases of mechanical obstruction. Fig. 898 shows some of their crude instruments. Until 1830 the sharp hook was mostly used for extraction, and it tore through the bladder and rectum as often as it safely delivered the head.

**Craniotomy.—Indications—**(A) *On the Dead Child.*—No accoucheur should have any compunctions about mutilating a dead child, yet I have seen the most atrocious operations carried out by physicians in order to avoid the necessity of perforating a piece of lifeless clay. Either they fear opprobrium, or they overrate the dangers of craniotomy. Craniotomy is chosen, the fetus being dead, when an indication arises for the immediate termination of labor. Craniotomy is less dangerous than the forceps, especially if the child is large, the pelvis small, or the soft parts unprepared. It is the rule for hydrocephalus. Sentimental reasons advanced by the family should not stand in the way of the accoucheur's doing the best for the mother.

When the child is surely dead, even if there is no indication for the immediate termination of labor, perforation of the cranium and reduction of its size may be desirable. This is true of primiparæ—we wish to save the levator ani and pelvic outlet from overstretching, and, further, it is thus possible to shorten the time of labor. It would perhaps be best in such cases to perforate the cranium, evacuate

a large part of the brain, and leave the expulsion to nature. In private practice unless the family is intelligent, objections will be raised to the disfigurement of the child, or even its death may be ascribed to the attendant. In delivery of the after-coming head, the fetus having died, hurry should cease, and the head be perforated. It is not wise to delay too long, since much blood may accumulate behind the head.

(B) *When the child is living*, the indication for craniotomy is dreadfully rare.

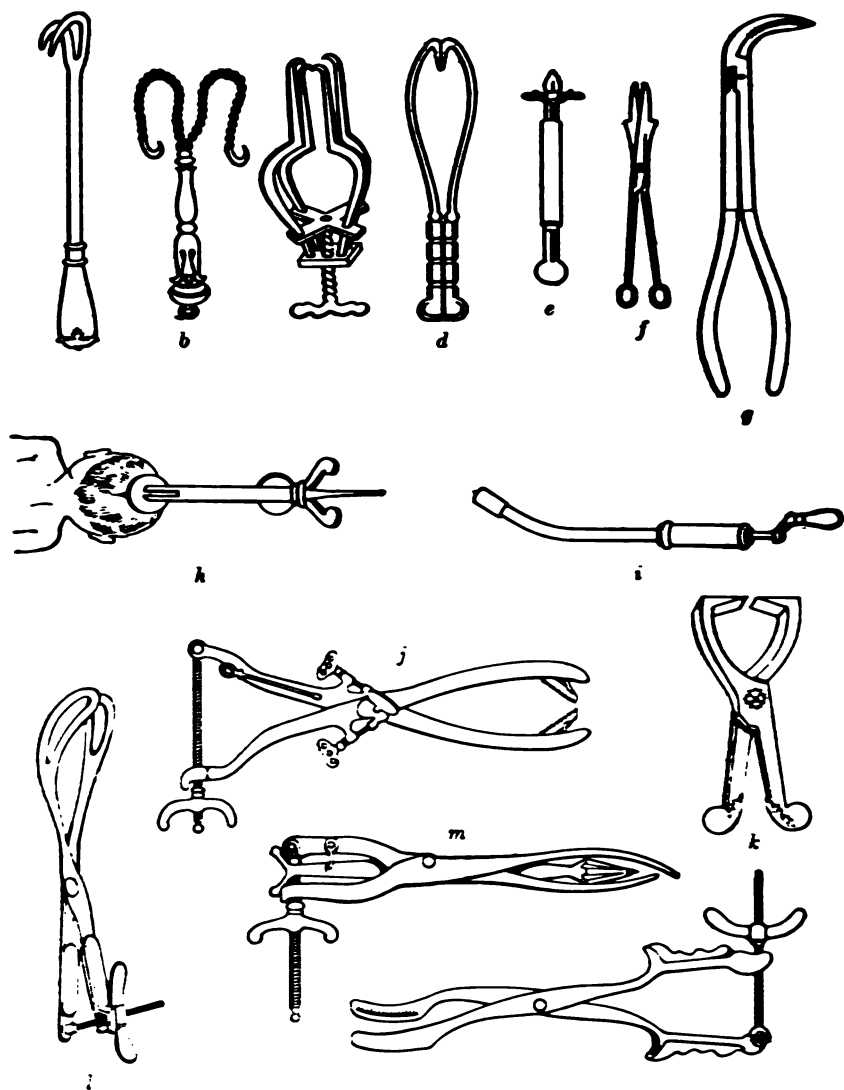


FIG. 905.—TYPES OF DESTRUCTIVE INSTRUMENTS.

a, Ambrose Pare; b, Andre De La Croix; c, Ambrose Pare; d, Levret; e, Burton's perforator; f, Bonelli's cranioclast; g, Meigs; h, Maunier; i, trephine of Braun; j, Pajot; k, Ambrose Pare; l, Lusk's cephalotribe; m, Tarnier's basiotome (recommended); n, C. Braun's cranioclast.

to place. Nowhere in all medicine does so heavy a responsibility rest on the medical attendant. He is judge, jury, and, perhaps, executioner of an innocent baby, and he can hardly be blamed if he shrinks from the painful task. However, if he has not the moral courage to do that which his judgment tells him is the best for the mother, her family, and the State, he should give way to a better man. See Strat. It is imperative to have consultation whenever the question of craniotomy on the

living fetus arises. The decision will rest not alone on scientific grounds, as we shall show directly.

In practice, craniotomy will come up for consideration in cases of moderately contracted pelves, in incorrigible occipitoposterior positions, face and brow presentations, and tumors blocking the passage. Regarding the course of conduct of contracted pelves, the reader is referred to the appropriate chapter. The conditions almost always met are these: The woman has been in labor many hours or even days, unclean hands have frequently examined her, attempts at delivery with the forceps have failed, the vulva is torn and bruised, the cervix hangs in shreds, the urine is bloody, the child is injured or perhaps dying. Here there is only one course—craniotomy. The responsibility for the death of the child rests on those who conducted the labor up to this point. On the other hand, if the woman is not injured, not infected, and the child is in perfect condition, one is not justified, at least from a scientific point of view, in doing craniotomy.

Pinard and a few Catholic authors demand the abolition of craniotomy on the living child, but the overwhelming majority of obstetric authorities declares this extreme position untenable. All, however, agree that the necessity for destroying the child is less and less frequent as the diagnosis of spacial disproportion is earlier discovered, giving a chance for cesarean section and pubiotomy. It follows, therefore, that craniotomy will be more frequently performed in home practice. In a good maternity the necessity for sacrificing the babe will be of the rarest occurrence. For centuries craniotomy was the opprobrium of obstetric science. It is this no longer in the science, but remains such in obstetric practice. The newer methods of cesarean section bid fair to bring the necessity for craniotomy on the living child almost to the vanishing point.

Legally, the mother has a right to demand that she be exposed to no unusual danger for the sake of her child, and she may refuse to do so even at the request of her husband. Also, she has the right, even if opposed by her husband, to run added risk for its sake if she wishes. The legal status of the unborn child is still unsettled (Kiernan). At present it is part of its mother, and has no legal existence until the cord is cut. The mother may recover damages for its loss by wilful or negligent means, though itself it has no redress if it survives the injury. The moral and ethical aspects of the question are too broad to be more than mentioned here. The stand of the Catholic Church has been alluded to,—“Non Occides!”—and in such families the attendant is guided by the word of the priest, who is always to be summoned. If the accoucheur is convinced that the cesarean section demanded would kill the mother, he may retire from the case. On the other hand, if the family insists on the sacrifice of the child, when the accoucheur feels that there are good chances for a successful cesarean section, he should likewise decline, but, legally, he must stay by the patient until another qualified practitioner has assumed charge.

Is consent of the patient or next of kin necessary? Legally, yes—indeed, the attendant could be held for malpractice if the mother suffered injury from an operation less safe than a craniotomy, performed without her consent. The facts of the particular case are to be laid, unvarnished, before the family for decision, which is their right. Here much depends on the ability of the accoucheur in prognosis, for he has to evaluate the condition of the mother and of the babe and to foretell their probable chances of life and health, admittedly a very difficult and delicate task. After all, the family will usually rely on the accoucheur's judgment, and he will be immensely aided and comforted by adherence to the Golden Rule.

After craniotomy it is the accoucheur's bounden duty to warn the family that the next labor should be so conducted that a child-life saving operation may be done. A second craniotomy is criminal.

In posterior occiput positions not amenable to the usual treatment, and where the forceps fail, craniotomy may be necessary. Forced forceps deliveries here, as well as in face and brow presentations with the chin posterior, are equivalent to craniotomies as far as the child is concerned, but have not the saving grace of the latter in sparing the woman from serious, often fatal, mutilations. Let no man pride himself on having accomplished a hard operative delivery with a whole but dead child. Let him ask himself if craniotomy had not been more humane.

Craniotomy is not a good operation when a tumor is impacted in the pelvis. Necrosis of the tumor often ensues.

*Conditions.*—The pelvis may not be too contracted. Barnes believed it possible to deliver a mutilated fetus through a conjugata vera of less than two inches, but most authors place the limit at 6.2 cm. for flat and 6.5 cm. for generally contracted pelves. Naturally, these figures must be raised if the child is of unusual size or hardness. The cervix must be well dilated or easily dilatable—the more the better.

**Technic.**—In addition to the special instruments for craniotomy, all those used in a forceps operation should be added. Naegeli's perforator (Fig. 909) is one of the best, but the trephine makes a large opening in the skull, and the vagina is less likely to be injured by specula if one who has used some of the rubber gloves of the accoucheur (Fig. 910). For crushing the pericranial head the best instrument is Anvard's cranioclast (Fig. 911). It has three blades, and while it is difficult to apply, and the generally recommended Carl Braun instrument, it does better work.

The preparations for the operation are as complete as usual.

The head is steadied by an assistant from the outside, or seized by means of



FIG. 909.—NAEGELI'S PERFORATOR.

strong viselium forceps sunk into the scalp. In some cases I hold it with the ordinary forceps. Under cover of the whole hand the perforator is introduced and applied to the most accessible portion of the head, care being taken that it does not glance off, which advice is to be specially heeded when the cutting perforator is



FIG. 911.—ANVARD'S CRANIOCLAST.  
Model of the instrument, showing the blades.

used (Fig. 912). It was possible to expose the head by specula and do the operation easily. After the opening is made, the head is locked into it, then the brain matter is crushed with the cranioclast (Fig. 913), taking special care not to tear the tentorium and destroy the medulla, thus to avoid the painful experience

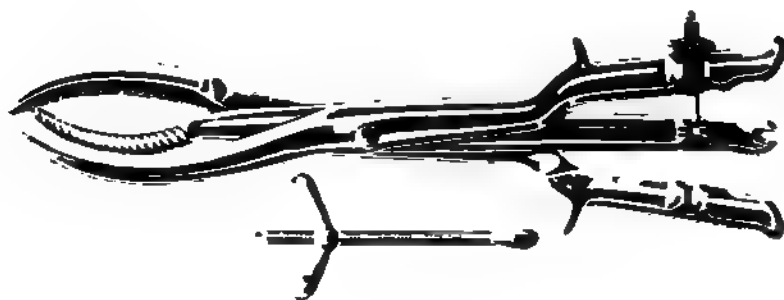


FIG. 913.—ANVARD'S CRANIOCLAST, SHOWING THE BLADES.

and the use of the cranioclast. The cranioclast is used with the hand steady, and the head is held steady by the assistant. The cranioclast is used with the hand steady, and the head is held steady by the assistant. The cranioclast is used with the hand steady, and the head is held steady by the assistant.



## MUTILATING OPERATIONS ON THE CHILD

over the face of the child, and while this is held by an assistant, the solid blade is pushed into the skull to the base. By means of the compression screw the two blades are brought slowly together, *but after they are locked and before they are tightened the accoucheur should assure himself that nothing is caught in the grasp of the jaws.* When the handles are in contact, the two are locked with the hasp, then the third handle is applied and also screwed down tight. The fourth act—extraction—is done with the same care and gentleness as the forceps operation, and the proper mechanics of labor should be followed. There is no occasion for hurry. Frequent examinations are made to determine if the head is following, to preserve the parts from injury by spiculae of bone, which may be sharp and piercing, and to aid in stripping the cervix back over the head. If the instrument is well applied, it will not slip; if it does, it is to be reapplied, and higher up, grasping the face. Spiculae or edges of bone are removed by means of the Mesnard-Stein bone forceps (Fig.

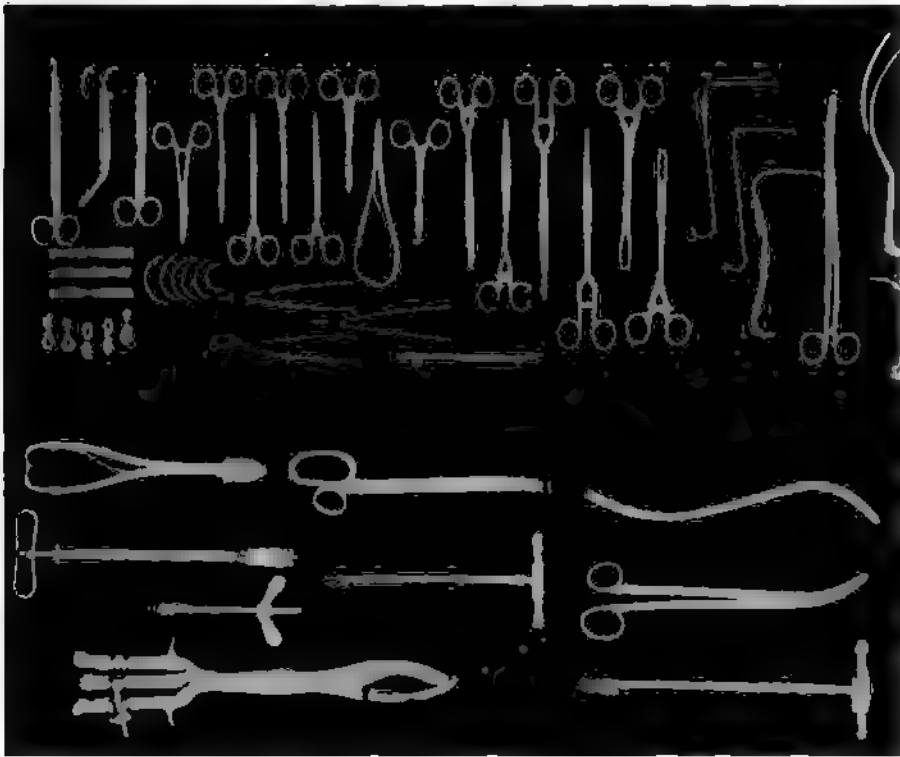


FIG. 912.—INSTRUMENTS FOR EMBRYOTOMY.  
The same instruments as for forceps, plus the destructive instruments.

The perineum is to be preserved by slow delivery—at least, the woman should be spared injury of this structure.

In many cases, after the head is delivered, the shoulders are arrested. It is not prudent to use force. The size of the shoulder-girdle is reduced by the operation of *cleidotomy*. One hand searches for the more accessible of the two clavicles; under the guidance of this hand the tip of the decapitation scissors is passed over the point on the neck of the child adjacent to it. With tiny snipping motions the point of the scissors are pushed under the skin of the neck, and, guided by the finger, the other clavicle is reached and cut. The other is treated the same way. It is now possible to deliver the trunk of the child. In very exceptional cases the sternum may be bisected and the chest emptied—this in cases of monsters or anasarca. If delivery of the trunk still causes difficulty, one arm may be brought down and traction

on it, or, better, the blunt hook is passed into the axilla and combined traction made on it and the head.

If the craniotomy is performed in face presentation, the perforation is made



FIG. 913.—PERFORATION WITH TREPHINE.

through the glabella or through one eye, using the Naegelè instrument. If on the after-coming head, the opening is to be made through the nasopharynx, via the

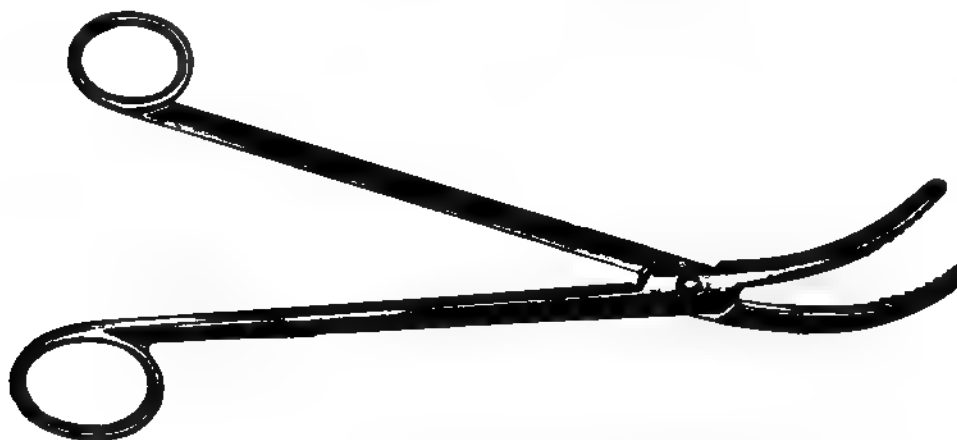


FIG. 914.—MURWARD STEIN BONE FORCEPS.

mouth, to avoid disfigurement of the child, or, if this fails, through the more accessible side of the head. Naegelè's perforator is the best here, and a large opening

to be obtained. Thorough evacuation of the brain by irrigation is essential, and it usually is not necessary to crush the skull, slow traction causing it to collapse.

It is not wise to cut the body off the head under the notion that thus the latter

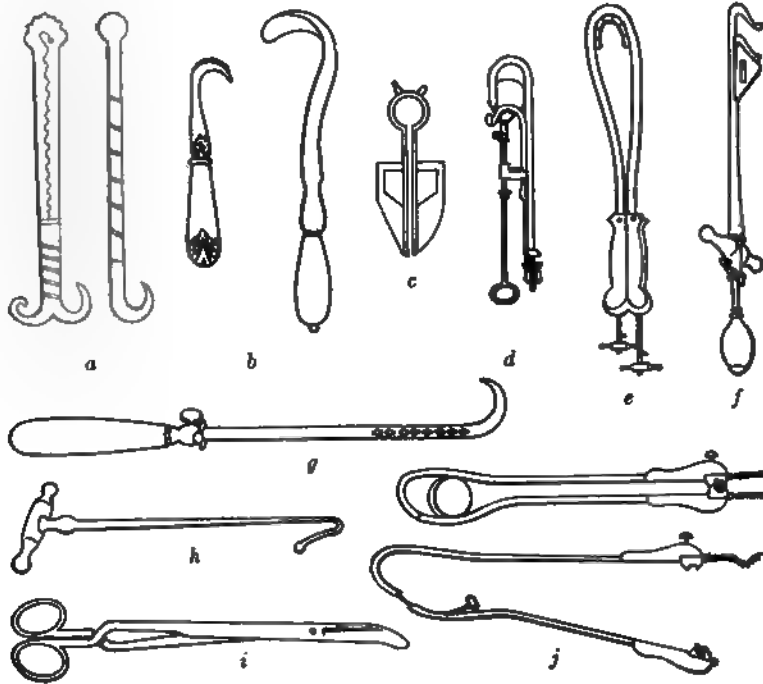


FIG. 915.—INSTRUMENTS FOR DECAPITATION.

a, Arabian; b, Ambroise Paré; c, Abulcasis; d, Baudelocque; e, Van der Ecken; f, Tarnier's embryotome; g, Jacquemier; h, Braun's hook; i, Dubois scissors; j, Ribemont Dessaignes' chain saw.

will be more accessible. One loses a good handle on the head. If this accident has happened, the floating head may be steadied with a strong vulsellum forceps, then firmly seized with a pair of obstetric forceps, perforated with a trephine, crushed with a cranioclast, and extracted. If the pains are strong and the accoucheur is

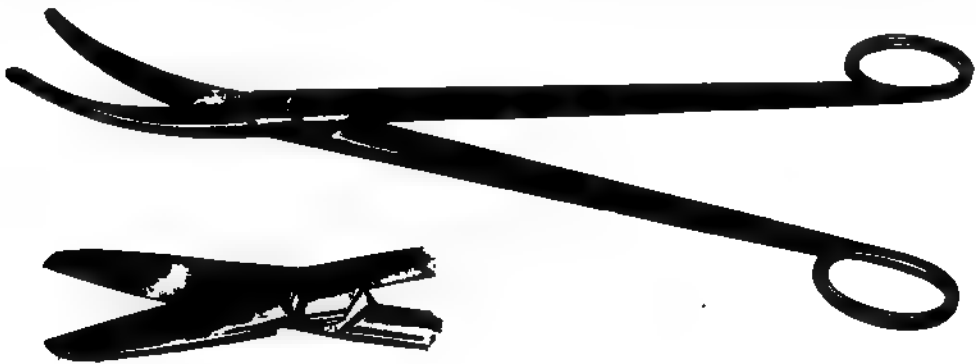


FIG. 916.—DECAPITATION SCISSORS.

certain that blood is not accumulating in the uterus, the delivery of the head may be left to nature. I usually do not wait.

In all cases as soon as the mouth of the child is accessible the throat is to be stuffed full of wet cotton, because sometimes the elasticity of the chest causes the

child to make a sort of inspiration which the by-standers mistake for evidence of life. After craniotomy, a hot uterovaginal douche of sterilized water is given and it is my custom to tampon the uterus lightly.

Decapitation.—Hippocrates did decapitations, using a curved



FIG 917.—DECAPITATION HOOK.



FIG 918. DECAPITATING WITH JARVIS'S HOOK.

all operations, nowadays, owing to the general improvement of obstetric neglected transverse presentation is the usual indication, but sometimes to decapitate the first of interlocked twins, and, still more rarely, in that of double monsters. The conditions for the operation are the sameotomy, and the same question will arise as to the propriety of performing child lives. In neglected transverse presentations, however, it is most for the child to be found alive. Of prime importance in these cases is the knowledge of the state of the uterus. If the lower uterine segment is thinned, indeed, on the point of rupturing, decapitation should be by evisceration, because this operation will not increase the distention—opposite. If the shoulder is wedged deeply into the excavation, the neck is held almost parallel with the long axis of the fetal body, evisceration is a solution. If the neck is readily accessible and the uterus not dangerously distended, decapitation is a very satisfactory operation. Fig. 915 shows some of the instruments used for severing the neck. Carl Braun's hook has been modified by making the inside somewhat sharp—an improvement. I have usually performed this operation as here described, all under the guidance of the hand, but with advantages in doing it with the aid of sight, the field being exposed by a hand and the neck being pulled down with the hook or powerful vulsella.

*g.*—To make the neck more readily reached, traction is put on the arm. Passing a hand into the vagina, the neck is encircled by two fingers and the thumb. Guided by the hook is passed over the neck, where it is firmly pulled into the soft parts. No traction should be made until the hook is well placed and the fingers are apposed to the neck, encircling the neck and guarding the mother's tissues from injury. Now the handle is pulled at the same time, turning the knob in the direction of the head. The hook breaks the cervical spine, after which the hook takes a deeper hold on the muscles, severs these. The skin now remains, and this is packed into the hook by means of a few complete turns cut it with the cleanness of a knife. Sometimes a few tough vessels are severed with the scissors (Fig. 916).

*ct.*—Extraction of the trunk is made on the prolapsed arm; only rarely is it necessary to cut the chest or apply the hook to the trunk. The neck must be covered by the fingers to protect the vagina from being pierced by spiculæ of bone.

*t.*—Delivery of the head is accomplished by expression from above, traction on the arm, or, if need be, by forceps or even craniotomy. In the latter instance the head is fixed either by the forceps or by strong vulsella. Sharp projections of bone may be removed if unobserved.

**Operation.**—In cases of arrested delivery of the child, in conduplicatio corporis (34), the neck is inaccessible to the hook or the scissors. Exenteration is the operation. A large hole is made in the chest with the scissors, several ribs are removed. With the fingers the entrails are pulled out—first out of the chest, after boring through the diaphragm, out of the abdomen. Usually the child lapses, and the child can be easily extracted, but if there is the least resistance the vertebral column should be cut through with the scissors (spondylotomy), a safe procedure, since the instrument operates inside the body of the child, the soft parts being protected. Now the extraction may be made by traction on the arm or pulling down the feet of the child, or by hooking the blunt end of the vertebral column.

#### LITERATURE

- b. für Gyn., 1912, p. 599.—*Kerr*: Operative Midwifery.—*Kiernan*: The Alienist and Neurologist, 1913.—*Spencer*: Personal communication, 1913.—*Stratz*: Zeitschr. für Geb. u. Gyn., 1915, p. 724.

ancient Greeks performed abortion for the same reason. Soranus the second century, mentions it.

**Indications.**—There is hardly any condition affecting the pregnant woman which may not give the indication for emptying the uterus. The most common are, first, contracted pelvis, the idea being that a small fetus will pass; and, second, diseases which affect the health of the woman so deeply that she will not survive until term, or that the disease inroads on her constitution as materially to shorten her life. The indications may be grouped under the following headings: 1. Contracted pelvis. 2. Diseases which are incidental to pregnancy. 3. Diseases accidental to pregnancy. 4. Habitual death of the fetus but before term. 5. Prolonged pregnancy and overgrowth.

For contracted pelvis see p. 731. Under diseases incidental to pregnancy see the chapters on Eclampsia, Toxemia, Chorea, Pernicious Vomiting, Placenta Prævia, Abruptio Placentæ, Psychoses, Multiple Mole, Herpetiformis, Polyhydramnion, Hydatidiform Mole, etc. The treatment is to stop the gestation at a point before either mother or fetus are in danger, either to life or to health.

Under diseases accidental to pregnancy see the chapters on Tuberculosis, especially of larynx, Heart Disease, Diabetes, Rheumatism.

A very interesting condition is the habitual death of the fetus but before term. In apparently healthy women successive abortions occur just before labor or directly after. Sometimes the boys die, sometimes the girls. The causes are mostly unknown. Syphilis is the most common, and even if no history of the same is forthcoming, and even if the Wassermann reaction is negative, to submit both to a mild mercurial treatment and to a course of iodine has encouraged me to continue this plan. During pregnancy administer three times daily: Hydrargyri iodidi rubri, gr.  $\frac{1}{4}$ ; Acidi arseniosi, gr.  $\frac{1}{8}$ . Bright's disease in a latent form, anemia and constitutional disorders, diabetes, adiposity, and hypothyroidism. Smith says hypothyroidism causes stillbirths in sows. The decidua and ovum from a distant focus (e. g., tonsil, teeth), with

in addition to this good results have been observed in a complete reversal of the usual mode of life. For example, a man overloaded with business cares may be sent, with his wife, to spend six months in camp on the plains or in the mountains.

If the exact time when the children usually die is known, labor may be brought on a few weeks before this. In some of these cases every alternate child dies, or the habit is broken up from some cause or other. It will be noticed that this indication is precarious, but most authors allow it.

*Prolonged Pregnancy and Overgrowth of the Child.*—Some women habitually go over the usual period of pregnancy, and not seldom the child dies or suffers so much during delivery that it succumbs shortly after. In these cases the cranium is usually hard and angular, the bones stiff and unmoldable, the flesh firm and unpliant, and the body-length increased. In some instances the child as a whole is of greater size than ordinarily, and the mechanical labor difficulties are pronounced. I have already (p. 652) discussed this subject, and stated that my practice is not to allow the women to go too far beyond term. Some women come to the accoucheur giving a history of difficult labors with immense children. It is wise to accept the story with much reservation, because often, for various reasons, the previous attendant will exaggerate the size of the child, and again the patient herself will do the same, sometimes forgetting. Nevertheless, such a pregnancy requires watching, and if the child actually does grow too large, it is best to interrupt it.

*Conditions.*—The child must be living and viable in all cases where the pregnancy is terminated in its interests. It may not be deformed. A child delivered before the thirtieth week of gestation has but little chance of survival. Speaking broadly, with every week of gestation after this period the child's chances improve 10 per cent. In determining the size of the child by palpation the possibility of twins is to be borne in mind.

The pelvis may not be too markedly contracted, it being generally conceded that in pelves below 7 and  $7\frac{1}{2}$  cm. the outlook for an infant, even at the thirty-second week, is dubious.

The condition of the mother must be such that she will probably live through the operation. Although several cases are on record of the operation being done on a moribund woman, actual practice seldom justifies it. The consent of the mother or next of kin must be obtained, and in all cases a consultation is essential, first, because human judgment is fallible, and, second, to avoid legal entanglements later. A written statement is desirable.

*The Prognosis.*—In a collection of 2200 cases Sarwey found a maternal mortality of 1.4 per cent.—0.6 per cent. due to infection, but part of this may have been due to causes not inherent in the operation itself. Nowadays, with our perfected technic, the induction of labor should be without mortality ascribable to infection carried in by the accoucheur, but it is not possible always to avoid infecting the woman with virulent bacteria already present in the genitalia, for example, in gonorrhea, in the urine from a ureteropyelitis, even those of the ordinary vaginal flora. If, as not seldom happens, the operation requires repeated internal manipulations extending over several days, the streptococci in the vagina, given blood, bruised tissue, and a depressed woman, acquire invasive virulence; therefore it is not uncommon in prolonged cases, in spite of the most painstaking aseptic technic, for the patient to have fever, and in a few cases fatal sepsis may arise.

The morbidity is not small. Dilatation of the cervix is usually imperfect and lacerations are common, which is also true of the pelvic floor to a less degree. Operative termination of the labor is oftener required, which carries with it the dangers so often referred to. If the uterus is very sluggish, the various operations have to be repeated day after day. Such cases act badly on the nervous system of the patient. In a few cases on record the attempt to get the uterus to act had to be abandoned, and the pregnancy went to term. Some of the methods employed

*Puncture of the Bag of Waters.*—This is the oldest method. Denman in 1793, as the generally known, probably only, one. instrument may be used, as a scissors, but where obtainable, a pair of forceps may be used. By forcing the head down into the cervix, by allowing the water to rush out in a stream, perhaps using the Sims' position, the rupture may be prevented. If the head is movable and prolapse of the membranes is better to substitute another method. In primiparæ, with all the advantages of a dry labor are to be borne in mind. Puncture of the membranes is the most certain of all methods, and may be used when other, more gentle, methods fail.

*Bougies.*—Krause, in 1855, introduced one or two elastic bougies into the uterus between the membranes and the wall. Though this method is not popular, I hardly ever use it, finding it inefficient (the pains seldom lasting more than forty-eight hours) and somewhat dangerous. In two cases of menorrhagia it was encroached on, with severe but controllable hemorrhage. The membranes may be punctured, and I think the danger of infection is high in these methods. In a case seen in Berlin necrosis of the track of the bougie occurred postmortem.

By the light of broad specula the cervix is exposed, and two soft-rubber bougies passed into the uterus, going to either side, till they meet, with the least resistance. If the least blood appears, both are removed. The vagina is then packed. Next day another method of induction, by the use of the membranes, is to be practised.

*Dilatation of the Cervix.*—Hydrostatic dilatation of the cervix is used to hasten labor and in the treatment of placenta prævia. A bag of india-rubber dilates it and stimulates the pains. The technique has already been described. When the bags are used simply to start labor pains, the small-sized bags are used. Pains usually come on within six hours, but often subside immediately, requiring the insertion of another. Sometimes the pains continue for several days, even if larger and larger bags are put in every day. It cannot be denied that sometimes the bag displaces the head, and presentations and prolapse of the cord to occur, killing the baby.



cesarean section is the method of choice, though occasionally the abdominal route is to be selected.

In cases of sufficient urgency, but less than the last, puncture of the membranes and the insertion of a balloon dilator will be the methods of choice, followed later by manual dilatation of the cervix and delivery.

Where there is no great hurry, my practice is as follows: The patient is prepared as for any major obstetric operation. Under the strictest aseptic precautions the cervix is dilated with the finger-tip and straightened, then the region just above the internal os is loosely, and the cervical canal tightly, packed with gauze, as described on p. 933, leaving no ends hanging out the vulva. I usually do this about 5 P.M. The patient is allowed a light supper, and one hour after this a single dose of castor oil is administered. Pains usually come on by 3 or 5 o'clock the next morning, and as soon as they are well established, the gauze may be removed. If pains do not come on by 5 P.M. the next evening, the same procedure is repeated, or a medium-sized Voorhees bag is inserted. While the uterus may not have gotten into regular action, some pains always have occurred, and they have softened the cervix and produced some effacement. If, next morning, regular pains have not set in, the membranes are ruptured, and now, with very few exceptions, the labor goes on quickly. I occasionally use pituitrin in 3- and 5-minim doses to aid the uterine action, with fair success.

Irregular uterine action, abnormal contraction rings, malpresentations and malpositions of the fetus, insufficient dilatation of the cervix, nervous exhaustion, sleeplessness, prolonged anxiety of the patient, fever, prolapse of the cord, lacerations of the soft parts, operative interference, postpartum hemorrhage, and many other grave and less grave complications must be expected when you induce labor.

Premature children suffer severely from the traumatism of labor. Breech deliveries are especially fatal to them, therefore version, as a rule, is contraindicated. They are especially prone to fracture of the bones, cerebral hemorrhage, and atelectasis pulmonum.

If delivery is effected by forceps, episiotomy is desirable to spare the head the perineal pressure. After delivery it is essential that the lungs be well inflated, that the infant be kept warm, and that it be placed in a properly ventilated and disinfected incubator. Mother's milk and good nursing, however, are more important than the incubator. The best results are obtained by combining the three.

For the sake of completion a few obsolete and dangerous methods may be named: Puncture of the membranes high up in the uterus with a trocar; intra-uterine injection of water, hot and cold, of glycerin, milk, etc.; the Kiwisch douche—a stream of hot water against the cervix; carbon dioxid water irrigations of the vagina; vaginal tamponade; colpeuryesis; electricity; the x-ray; irritation of the nipples; medicines, as quinin, cimicifuga, ergot, cathartics, etc. (Literature in Williamson, *Jour. Obst. and Gyn., Brit. Empire*, August, 1905, p. 254.)

**Induction of Abortion.**—This operation has been done since remotest antiquity, and in savage as well as civilized lands. By some it was done to prevent overpopulation, and was a recognized procedure; by others to avoid the discomforts and dangers of the function of reproduction, or even the disfigurement of the person wrought by gestation, as in decadent Rome. The child was considered to be without a soul—only a growth on its mother. As a therapeutic measure, abortion was done long before Christ; indeed, the production of abortion by a physician for other reasons was considered unethical, as witness the oath of Hippocrates. The ancient Jews considered abortion a great sin, but admitted it as a means of cure of disease affecting the mother. The promulgation of Christian principles did much to stop the practice, at least openly, and soon the law made it a punishable offense. (See Lecky, *History of European Morals*.)

One of the saddest commentaries on our modern "civilization," in a so-

called religious and ethical era, is the prevalence of criminal abortion. A physician is not long in practice before he is approached with the request in a hundred ways, open or concealed, to perform a criminal abortion. Not alone the single woman, but the married, will come. All arguments will be brought to bear: that of friendship for a stricken family, the disgrace of a child under untoward circumstances, the impossibility of caring for a large number of children, ill health, even gold will be offered. The physician should allow none of these things to influence him to do an abortion, because, first, it is murder, and conscience will make his later days miserable; second, it is a criminal offense, and, performed in the most of such operations have to be done, infection will likely follow, and perhaps the death of the patient, with a prison term for the perpetrator, in the perspective; third, accidents, like perforation of the uterus and anesthetic deaths, are not uncommon; fourth, if he does it once he is a lost man,—the woman, no matter how firmly she has been bound to secrecy, will tell her friends, and soon his reputation as an abortionist will be established. There are other reasons, but the conscientious physician will not need any at all. A word of warning: Let the inexperienced physician beware of simulated disease. A woman will read up on some disease which she knows sometimes gives the indication for abortion, and will try to induce the doctor that she is deathly ill.

European countries at present are much concerned over the question of abortion in the case of rape of women in the invaded lands. Hartman, Pinard, Tissier discuss the French point of view. They agree that from both medical and legal points of view abortion is not justifiable, but they recommend the delivery of the mother in secrecy and the support of the child by the State. Ochs of Berlin (brother of the late obstetrician) says that legally abortion is allowable, but not according to medical ethics.

*Therapeutic abortion* is rarely indicated, and lately our general therapeutic methods have improved so much that few affections justify its performance. (1) *Contracted pelvis* with a conjugata vera below 6 cm., mentioned by Soranus of Ephesus in the second century A.D., and by Cooper in 1772, to avoid the terrific mortalities of the cesarean section. Nowadays, with the safety of cesarean section, the accoucheur should refuse to perform abortion for this indication unless there are other, sufficient reasons, *e. g.*, heart, lung, or kidney disease. (2) *Hyperemesis gravidarum* and other forms of toxemia. Without doubt, here is a real indication for abortion, but a restricted one. In cases of toxemic vomiting, with the evidences of involvement of the structure of the liver and kidneys, one should not wait too long before emptying the uterus. (See *Hyperemesis*.) (3) *Incarceration of the gravid uterus* is usually better treated by laparotomy. (4) *Advanced tuberculosis*, as shown by loss of weight, evening fever, hemoptysis, etc. Authorities believe that the progress, while not always stayed, is rendered less fulminant by interrupting pregnancy. A combination of hyperemesis gravidarum and tuberculosis is a positive indication for abortion, as also is tubercular laryngitis. (5) *Heart disease* is only an indication when the muscle is badly inefficient, in advanced myocarditis and discompensation. (6) *Diabetes and other constitutional diseases*, as under induced labor. (7) *Diseases of the kidneys*, especially if complicated by retinitis. (8) *Other diseases* which seriously jeopardize the mother: Basedow's disease, leukemia, pernicious anemia, chorea, etc. (9) *Diseases of the ovum*—polyhydramnion, hydatidiform mole, death. In the last-mentioned, hemorrhage from the uterus usually indicates interference, and then the procedure can be called true abortion; rather we are simply completing a process naturally begun. Hemorrhage during the early months of pregnancy may come from centuriata praevia, placenta marginata, cornual placenta, and chronic abortion, may require interference. Repeated bleedings are almost always followed by complete abortion. Sometimes the pregnancy continues to term, and trouble arises in the placental stage from placenta accreta and postpartum hemorrhage.

Again, a placenta prævia will show itself in the seventh or eighth month. While a few of my cases have gone to term—as a rule, I regard frequent hemorrhages in the early months sufficient indication for interference.

In one case, a neurotic, highly bred, "overcivilized" (Reynolds) woman, the psychic shock of the pregnancy was so great that the question of therapeutic abortion was seriously considered. I refused to do it, advising mental treatment, and the woman disappeared, but had she not, in my hands, quickly recovered from the continuous nervous excitement, the sleeplessness, the almost maniacal fear of pregnancy, which reminded me very much of the overwhelming terror some people have of thunder-storms, I am sure that abortion would have been justified.

The conditions for the operation are about the same as for induced labor. The moral and religious aspects of the case must be considered, never forgetting that in those cases where disease in pregnancy threatens the life of the mother, the induction of abortion is a conservative operation, "saving the mother," not "sacrificing the child," because, as Pinard says, the mother would otherwise become the "coffin" of the child. (See p. 1043.) Always insist on a consultation, draw up a written statement of the facts in the case, and have it signed by the woman, her next kin, and all the physicians in charge. Every appearance of mystery and secrecy must be sedulously avoided. It is best to perform the operation in a hospital.

**Technic.**—The operations may be divided into those done during the first eight weeks, those done from the eighth to the sixteenth week, and those from this time until the child is viable.

In the first eight weeks the uterus usually can be emptied all at one sitting. An anesthetic is not always required, but the accoucheur must be able to do everything with the greatest deliberation and comfort. A careful bimanual examination is made to discover an ectopic pregnancy or a retroflexion. The cervix is dilated with Goodell dilators of increasing sizes, this part requiring from fifteen to twenty-five minutes. Then the contents of the uterus are removed with the curet and polypus forceps, after which the cavity is lightly filled with a strip of gauze. This stops the bleeding, and when, next day, it is removed, it brings with it shreds of decidua which may have been overlooked. In rare cases the cervix is so hard that it is impossible or unsafe forcibly to dilate it. Here the cervix may be packed with iodoform gauze for twenty-four hours, when it will be found softened and dilatate. Perhaps a tent may be put in, but I do not recommend them, since I consider them dangerous. When haste is not demanded, the two-stage method may be chosen.

During the third and fourth month the abortion is done in two stages. On the first day the os is opened a little with a Goodell dilator, then with a curet the ovum is broken up, making certain that the amnion has been punctured; then the cavity of the uterus is lightly, and the cervix tightly, packed with gauze by means of the tubular packer shown on p. 933. Pains almost always start up within twelve hours, and if the packing is not expelled, at least the cervix is opened enough to put in one finger. If it is not, the packing may be repeated—this time I usually use a piece of weak iodine gauze. At the end of another twenty-four hours the uterus may be emptied, as described under Abortion. If the uterus must be emptied quickly, this may be done by anterior vaginal hysterotomy, but I do not advise the cutting operation as routine.

During the fifth and sixth months the process resembles the induction of premature labor more. The bag of waters should be ruptured, and a small-sized Voorhees bag inserted. In cases of great urgency vaginal cesarean section should be performed. Let me warn the accoucheur against the removal of a small fetus piecemeal through a long, narrow cervical canal. It will tax his skill to the utmost, especially if, as so frequently happens, the body is torn off the head, which bobs around in the blood in the uterine cavity. If he attempts this operation, every bit of the body of the fetus should be laid out on a clean towel, and he may not call the work complete until all the parts of the fetus are accounted for. After the placenta is removed, the whole interior of the uterus is lightly cureted, and finally the cavity is filled with gauze, which is removed the next day. *Wherever possible, the fingers are to be used instead of the curet or ovum forceps.*

There is no medicine which will safely bring on abortion, though many are vaunted for the purpose. Other methods of inducing abortion have been named under Induced Labor.

**After-treatment.**—Ergot and hydrastis, of each 10 minims, are administered thrice daily for a week. Douches are not used—only external washings with a weak antiseptic solution. The woman should lie abed for one week and only gradually assume her duties.

**Prognosis.**—The induction of abortion is attended by a certain, though in proper hands small, mortality. The dangers are infection, which is not always avoidable, since the woman may have it within her, and perforation of the uterus. I consider the operation of induced abortion one of the most dangerous in obstetrics. The most painstaking asepsis does not always guarantee an afebrile convalescence. Perforation of the uterus by the curet is sometimes very easy. It has happened to

every accoucheur of experience—either the cervix tears into the broad ligament or peritoneal cavity, or the curet, even the finger, goes through the wall of the uterus. In one recorded case the uterine muscle was so soft that the weight of the curet placed vertically on the extirpated uterus sufficed to make it go through to the peritoneum underneath. I confess I use the curet only with the greatest distrust, and rely on the finger with it entirely if the finger can gain access to the uterus. The ovum forceps are dangerous, and many cases are reported annually of the drawing out of gut and omentum through perforations in the uterus. Spiculæ of bone from a dismembered fetus may also puncture the uterine wall, and the lower uterine segment may be torn during forced attempts to draw the fetus through it. In all this the operation is not to be lightly undertaken, and is to be performed with the greatest gentleness and circumspection.

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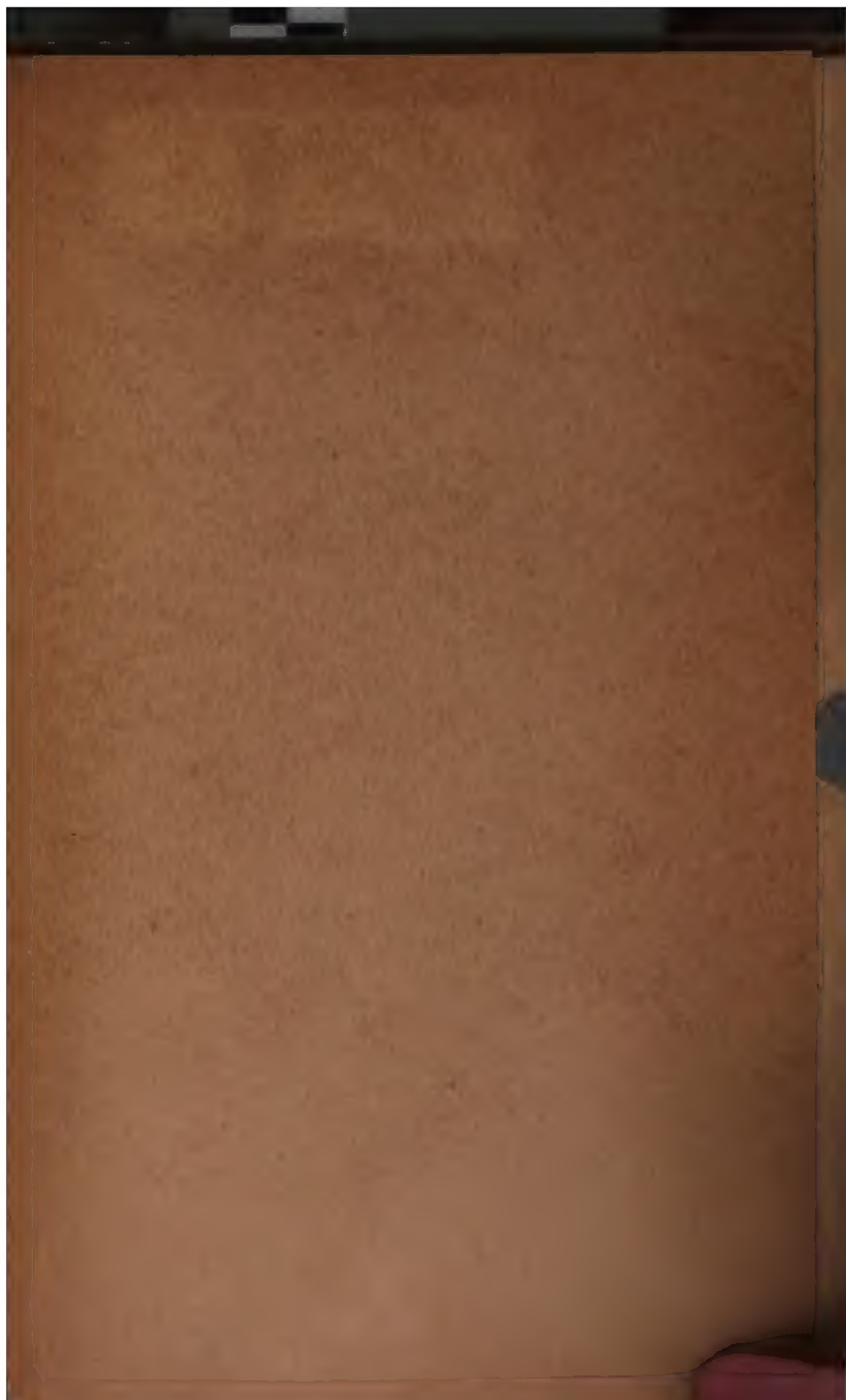
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